OFFICIAL PUBLICATION OF THE PROCEEDINGS AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS

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VOLUME 38, NO. 19

AMERICAN DYESTUFF REPORTER

DEVOTED TO TEXTILE CHEMISTRY • BLEACHING • DYEING • PRINTING • FINISHING

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Unchanging Shade in all lights

What dyer of woolens and worsteds has not had the problem of obtaining, with Chrome colors, browns unchanging in all normal illumination — natural and artificial.

Not only is such a problem solved with Erio Chromal Brown L S, but both manufacturer and consumer are satisfied with processing fastness and wearability.

Erio Chromal Brown L S is useful and interesting in light, medium and dark shades — can be employed on raw stock or piece goods by the conventional top chrome, bottom chrome or meta chrome dyeing methods or the Geigy High Temperature Dyeing Method.

Bulletin 15 G gives a more intimate story about Erio Chromal Brown L S.

Geigy

GEIGY COMPANY, *Inc.*

Dyestuff Makers Since 1859 89-91 BARCLAY STREET, NEW YORK 8, NEW YORK

BRANCH OFFICES: Boston • Charlotte, N. C. • Chicago • Los Angeles • Philadelphia
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IN GREAT BRITAIN: The Geigy Co., Ltd., National Buildings, Parsonage, Manchester

YOU CAN WIN BOTH EYE AND HAND approval with Cyanamid's Finishing Oils. They are extremely effective as softening agents for cotton, rayon and silk, and for hosiery and knitted fabrics. Grades for various textile finishing operations are available for use on the finest as well as for heavy work clothing fabrics.

YOU CAN LEVEL YOUR DYEING *and* dyeing costs with DECERESOL OT Wetting Agents because of their remarkable efficiency in achieving uniform level shades at real savings in time and expense. DECERESOL OT is the fastest wetting, penetrating and dispersing agent available.

YOU CAN SEE DOUBLE benefits — water repellency plus superior resistance to water borne stain — quickly obtained with Cyanamid's PARAMUL* 115 Water Repellent in a wide variety of fabrics . . . cottons, rayons, linens and woolens . . . for both outerwear and equipment purposes.

These Cyanamid Textile Specialties Help You LOWER COSTS AND INCREASE SALEABILITY

The Cyanamid textile specialties described briefly on this page are designed not only to lower your processing costs, but also to improve your product quality and *saleability.*

Investigate the opportunities they offer. Our textile research laboratories and technical staff are ready to co-operate fully with your staff in using these specialties to obtain the most satisfactory results.

Our descriptive booklets, "Textile Specialties" and "DECERESOL* *Wetting Agents for Textiles" will be mailed to you promptly on request.*

*Reg. U. S. Pat. Off.

AMERICAN *Cyanamid* COMPANY

30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.

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COPRANTINE COLORS

THE WAY TO BETTER

Wash and Light Fastness

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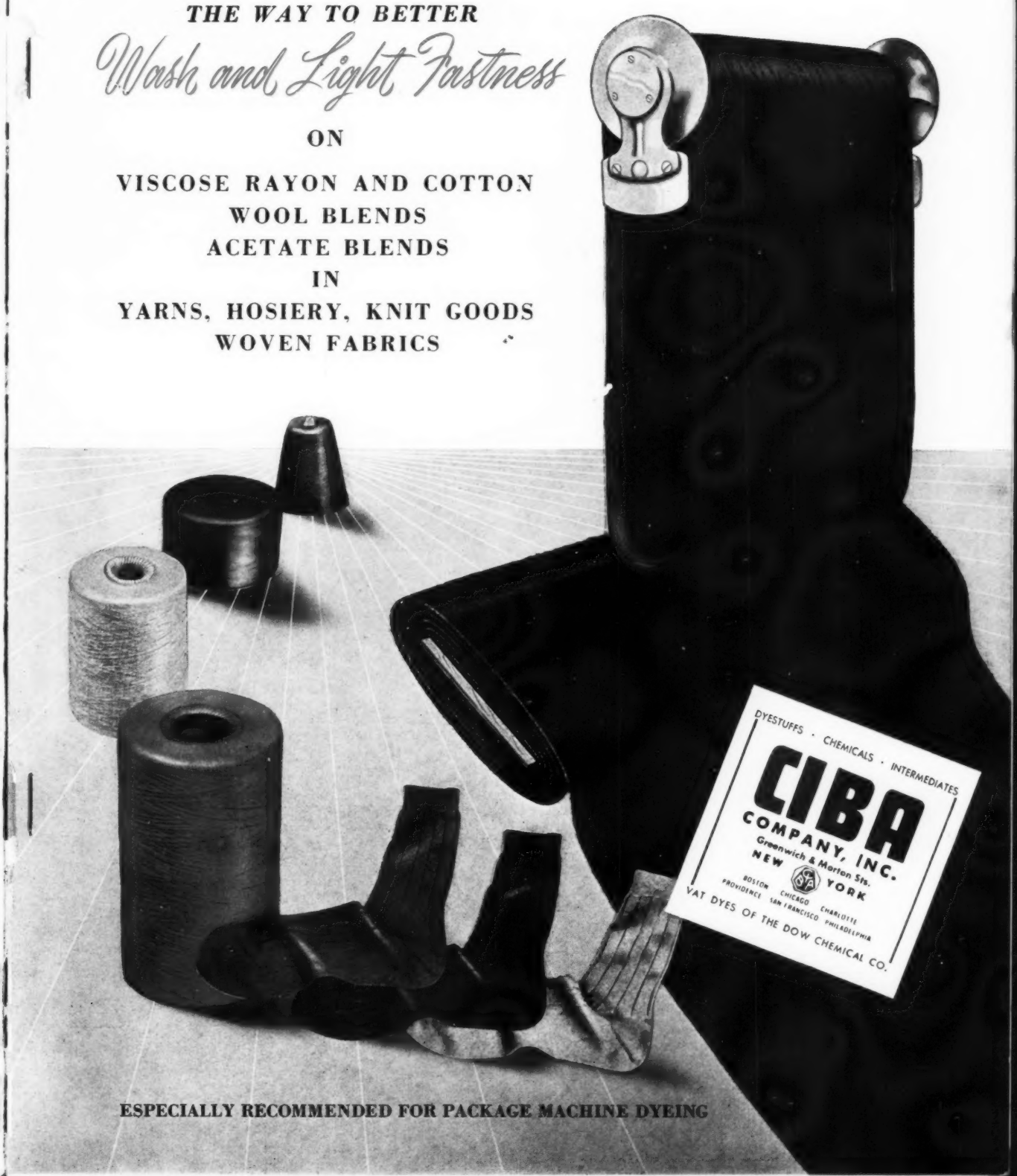
VISCOSE RAYON AND COTTON
WOOL BLENDS
ACETATE BLENDS
IN
YARNS, HOSIERY, KNIT GOODS
WOVEN FABRICS



ESPECIALLY RECOMMENDED FOR PACKAGE MACHINE DYEING

WIPE OUT STATIC

from Your Production Picture with NOPCO* 1656-R

the antistatic oil that assures better WORSTED production

Today, when speeded-up processes in worsted yarn manufacture tend to promote static, you'll find Nopco 1656-R an ideal trouble killer.

Fibers treated with this specifically formulated oil remain static-free throughout carding, gilling, combing and drawing operations.

You'll avoid "wild" and broken ends, produce even-running, quality yarn with this new, antistatic lubricant.

Nopco 1656-R also ***eliminates*** oxidation, and ***reduces*** soap costs **75%**. In fact, this remarkable new oil enables the worsted manufacturer to obtain exceptionally good results—comparable to those achieved by users of famous Nopco FUA oil for processing wool.

Yes, Nopco 1656-R means HIGH QUALITY WORSTED YARNS PRODUCED ECONOMICALLY . . . and in these competitive days what is of more importance to you?

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A Textile Utility
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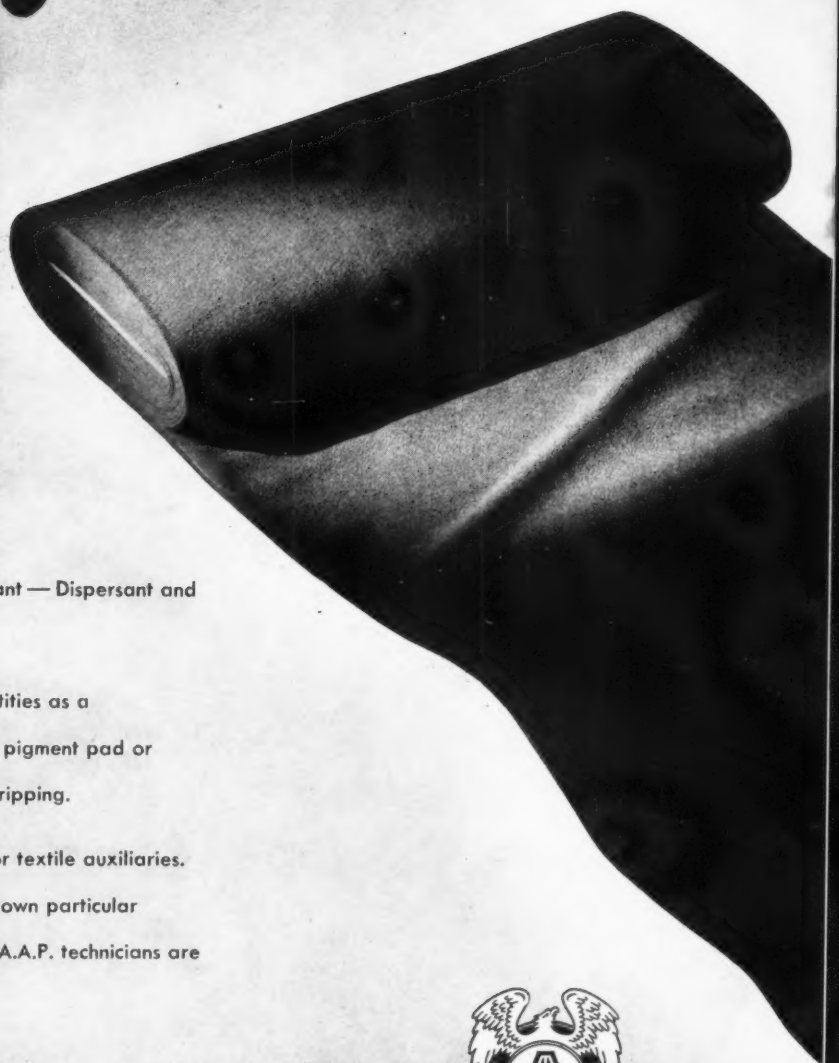
- preparing
- dyeing
- finishing



An effective Leveling agent — Penetrant — Dispersant and active Stripping Catalyzer.

Particularly well suited in minute quantities as a retardant for vat dyeing — either in the pigment pad or reduced methods — as well as for vat stripping.

Another of the A.A.P. range of superior textile auxiliaries. For detailed information regarding your own particular requirements consult our nearest branch. A.A.P. technicians are always happy to be of service.

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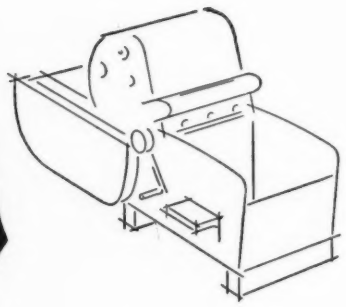
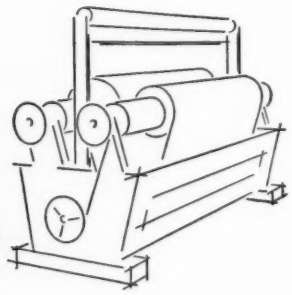
For these fibers... and these operations... use these detergents



SCOURING

Texscour Flakes, a low titer, pure red oil soap with easy solubility and rinsability.

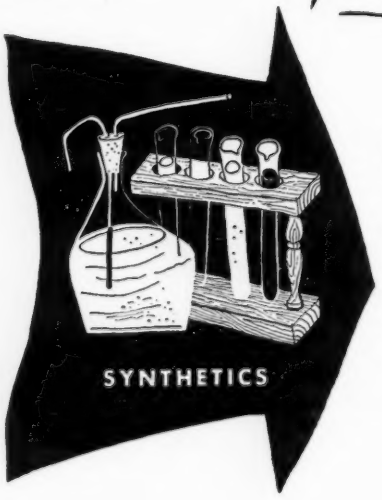
Triumph Synthetic, a low sudsing non-ionic, ready built powder with exceptional detergency.

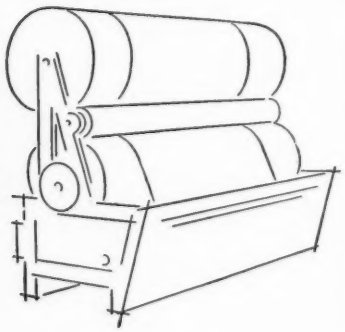


DYEING

Regal Synthetic, a neutral alkyl aryl sulfonate with excellent wetting and detergent properties.

Energetic Synthetic, an excellent neutral, non-ionic liquid detergent with dye-leveling action.





FINISHING

Flint Chips, a neutral high titer pure soap, free from rancidity, with good lubricant qualities.

Certified Flakes, a vegetable fatty acid base soap with rapid penetrating and emulsifying properties.

Write today for Armour's handy reference chart to help you select the right soap or synthetic for each textile processing operation.

ARMOUR *Industrial Soap Division*

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—Got a Textile Chemical Problem?

91*

YEARS say—

"MAYBE we have the answer!"

28 Years of **Woolen** and **Worsted** Trouble-Shooting!

40 Years of Experience with **Silks** and **Rayons!**

23 Years of Working with **Cotton!**

91* Years . . . Total experience of our experts!

There is only one real test for any service . . . that's a fair trial! Give us this test with your next textile chemical problem, large or small . . . We'll rest our case on our answers!

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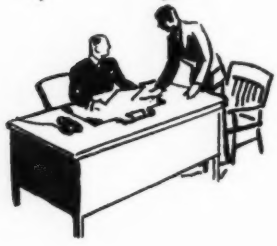
We need a Fatty Acid "tailored" for this job...

Call Hardesty-first for Fatty Acids!



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Write today concerning your particular fatty acid needs. After studying your specific requirements we can then recommend the most suitable grade and type which will be "tailored" to give you a superior end product with the lowest production cost.

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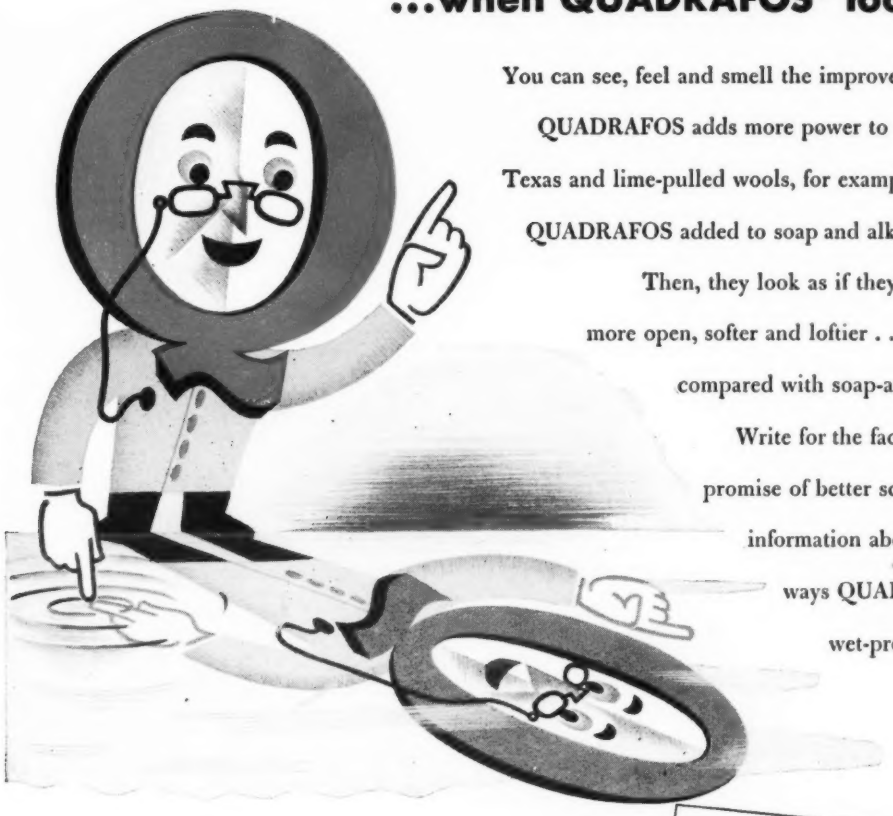
...when QUADRAFOS* looks into it



You can see, feel and smell the improvement when QUADRAFOS adds more power to your scour. Take Cape, Texas and lime-pulled wools, for example. Scour them with QUADRAFOS added to soap and alkali in the right proportion. Then, they look as if they were bleached... feel more open, softer and loftier . . . have little or no odor as compared with soap-and-alkali-scoured wool. Write for the facts that back up this promise of better scouring, together with information about the many other ways QUADRAFOS brightens your wet-processing picture.

softens water without precipitation...deflocculates ...redissolves precipitates...promotes free rinsing

ONLY WITH **QUADRAFOS** CAN WATER DO SO MUCH, SO WELL

*Reg. U. S. Pat. Off.

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Technical Service Department
20 Newman Avenue
Rumford 16, Rhode Island

Please send me further information about the use of QUADRAFOS in textile wet processing. I'm particularly interested in:

- ☐ Raw wool scouring
- ☐ Piece goods scouring
- ☐ Kier boiling
- ☐ Reducing bleach requirements
- ☐ Brighter, more uniform dyeing
- ☐ Viscosity control of printing pastes
- ☐ .....

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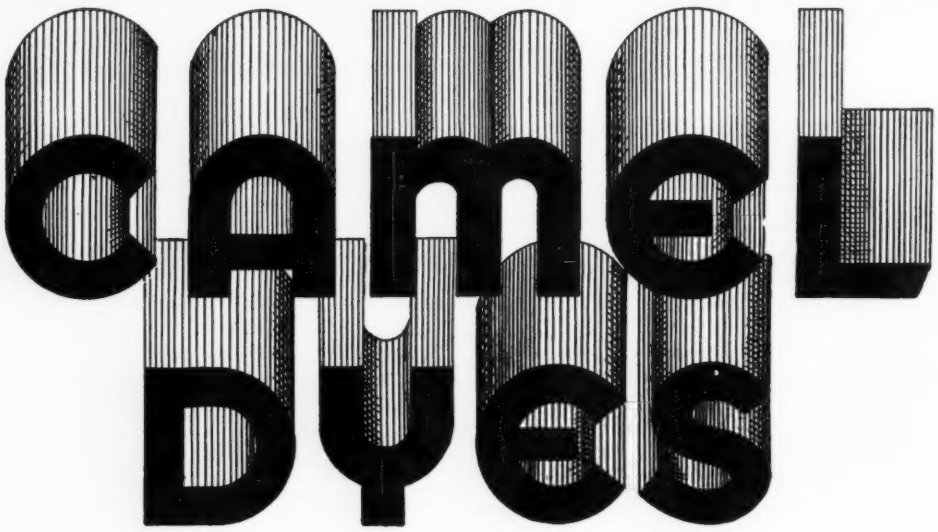

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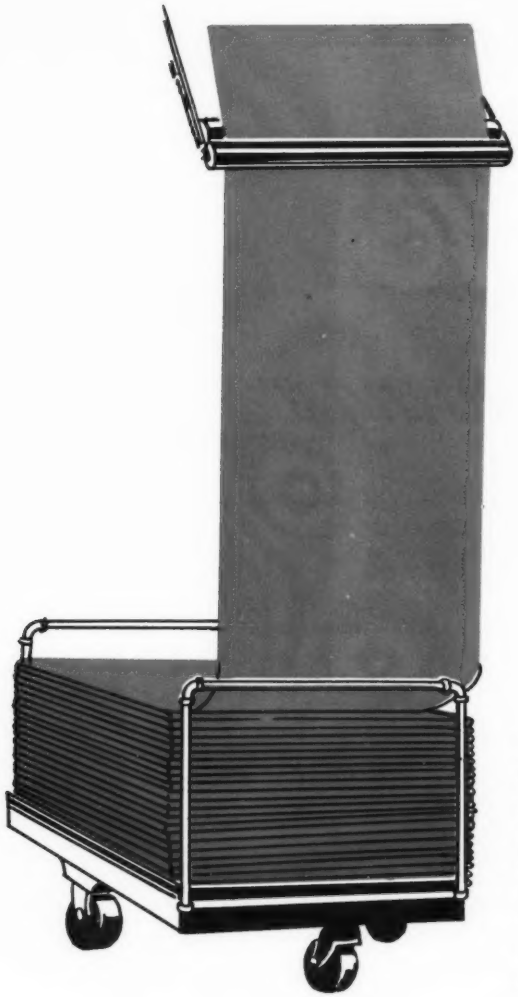

SANTOMERSE No. 1

Monsanto's versatile detergent and wetting agent for high-speed, continuous dyeing

Santomerse No. 1 gives you the detergency and penetration you need for efficiency in your high-speed, continuous dyeing operations. It makes important contributions to level dyeing and non-crocking.

Santomerse No. 1 serves in the reducing, oxidizing and scouring operations in the continuous range. In the various units, Santomerse No. 1 proves exceptionally efficient because it is effective in acid, neutral or alkaline solutions... because it penetrates thoroughly... because it lifts out particles and holds them in suspension for easy rinsing.

For further information on Santomerse No. 1, or other Monsanto detergents and wetting agents, mail the coupon, contact the nearest Monsanto Sales Office or write: MONSANTO CHEMICAL COMPANY, Desk H, Phosphate Division, 1779 South Second Street, St. Louis 4, Missouri.

MONSANTO SYNTHETIC DETERGENTS AND WETTING AGENTS

Santomerse* No. 1
Santomerse No. 3
Santomerse No. 3 (Paste)
Santomerse 30X
Santomerse D
Santomerse S
Sterox* CD
Sterox SE
Sterox SK
Sterox 5
Sterox 6

*Reg. U. S. Pat. Off.

Sterox No. 6, one of Monsanto's liquid nonionic synthetic detergents, can be used successfully in preparing goods for the pad box. Sterox is dried into the fabric before it gets to the pad, resulting in quick, even dye penetration.

Synergistic Action Steps Up Detergency and Lowers Costs

Monsanto Tetra Sodium Pyrophosphate, used with either Santomerse No. 1 or Sterox No. 6, creates synergism which increases detergency and lowers costs. Synergistic action is the result of two products working together to give detergency greater than the average of the two used alone... greater than the detergency of either. It is more economical because of this extra cleaning power and because TSPP is lower in price than either economical Santomerse or Sterox.

DISTRICT SALES OFFICES: Birmingham, Boston, Charlotte, Chicago, Cincinnati, Cleveland, Detroit, Los Angeles, New York, Philadelphia, Portland, Ore., San Francisco, Seattle. In Canada, Monsanto (Canada) Ltd., Montreal.

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Please send items checked: Data and quotations on ___Santomerse No. 1; ___Sterox No. 6; ___TSPP.

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how to —

save 4 hours

preparing vat pastes

Photo courtesy of AMERICAN VISCOSE CO.

Elapsed time? One-half hour instead of 4 to 5 hours required by cook-up thickeners!

How?

By eliminating cooking and cooling. Simply blend vat chemicals and tap water with AMBERTEX M. That's all. Your printing thickener is ready to use.

You save time . . . labor . . . expensive cooking equipment.

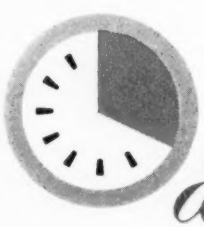
AMBERTEX M is another example of the *service* National research builds into textile starch specialties: Expense saving ease-of-preparation, in addition to excellent printing qualities.

AMBERTEX M is especially recommended for white discharge, rapidogen and vat colors. Clean, high speed printing . . . excellent penetration . . . smooth uniform blotches . . . washes out easily and thoroughly. Color yield? Up to 20% higher! AMBERTEX M deposits a soft, pliable film that minimizes splitting on Bemberg sheers and similar materials.

National also produces: CLEARFILM for sheer, lustrous finishes; FLOTEX to replace natural gums for printing; TABLE ADHESIVE for screen printing; FLOCK ADHESIVE 970 for chenille flock printing; HOOSIER PEARL CORN STARCH . . . THIN BOILING CORN STARCH . . . CHLORINATED CORN STARCH . . . and DEXTRINES

Address: 270 Madison Ave., New York 16; Boston, Philadelphia, Atlanta, Indianapolis, Chicago, San Francisco, and other principal cities. *In Canada:* National Adhesives (Canada) Ltd., Toronto and Montreal.

National
STARCH PRODUCTS



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Vat Dye Printing...

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LIQUID
POTASSIUM
CARBONATE

It's easy to use! It's convenient to handle! It's simple to store! SOLVAY LIQUID POTASSIUM CARBONATE gives you all these advantages—plus results you can be sure of. Order SOLVAY LIQUID POTASSIUM CARBONATE (47% K_2CO_3) in Tank Cars or Drums.

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Also Available:
Hydrated 83-85%
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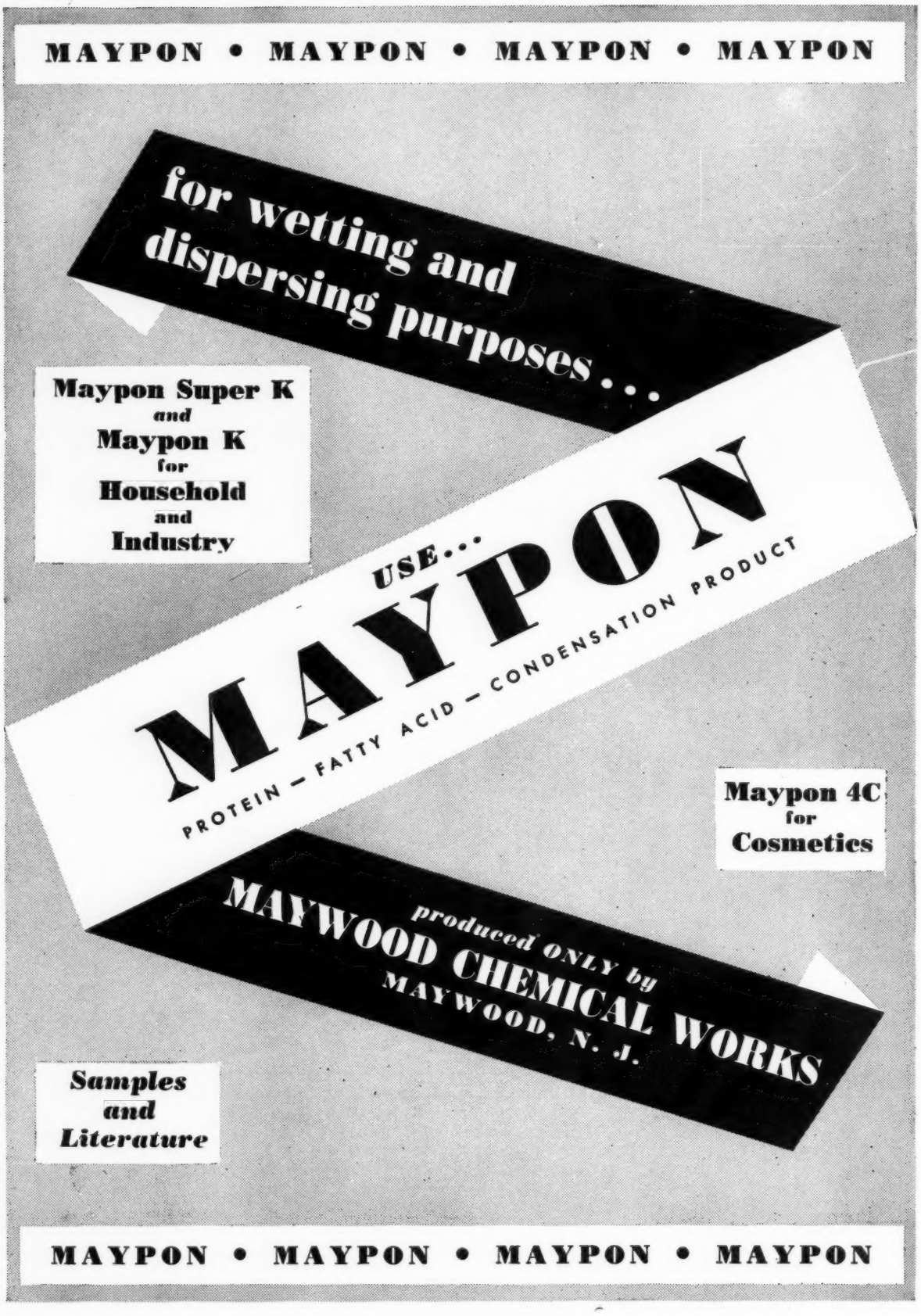
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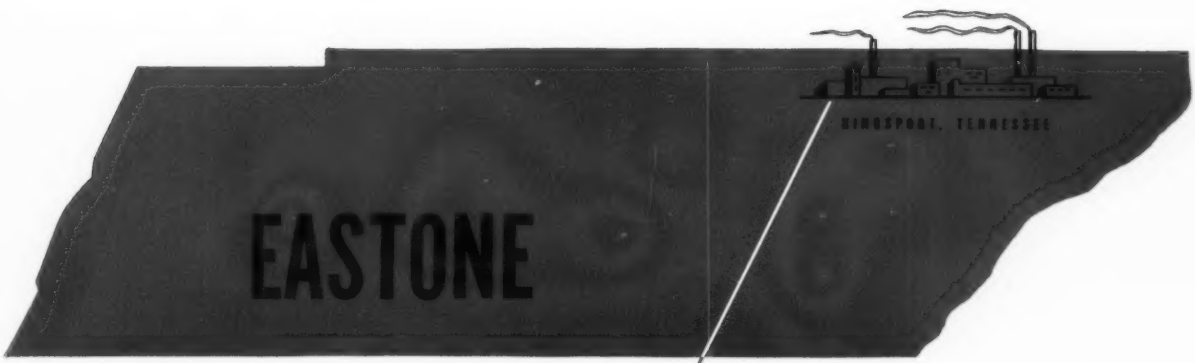
for plain or dischargeable dyeing of acetate yarn and nylon



BROWN 2R

Eastone Brown 2R, a straight, direct acetate brown, dyes acetate yarn a reddish brown and nylon a slightly duller shade. The unique shade and fastness properties of this dyestuff make it a valuable color for shading and for producing deep tertiary shades on a wide variety of fabrics which must meet certain fastness requirements.

A highly dispersed color, Eastone Brown 2R exhausts well at either high or low temperatures, and is suitable for both jig and box dyeing. Because of its good dischargeability, deeper shades of this dye can be obtained for roller printing. It is one of the fastest acetate dyestuffs available with respect to washing, and is highly resistant to atmospheric fading, light, perspiration, and sunlight. Eastone Brown 2R is highly recommended as the base color in formulating lining shades in conjunction with the gas-resistant azo blues.

Complete information on this and other Eastman Acetate Dyestuffs may be obtained by writing to Tennessee Eastman Corporation (Subsidiary of Eastman Kodak Company), Kingsport, Tennessee.

Eastman Acetate Dyestuffs

Eastman Acetate Dyestuffs are sold in the United States through Tennessee Eastman Corporation in Kingsport, Tennessee, and Lodi, New Jersey; in Canada, through Clough Dyestuff Company Limited, 33 St. Mathieu Street, St. Laurent, Quebec.

1949

CALCO dyelines

No. 10 of a series

PUBLISHED BY AMERICAN Cyanamid COMPANY / CALCO CHEMICAL DIVISION
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ADDED BRIGHTNESS WITH FLUORESCENT WHITES

Calcofluor* White B and Calcofluor White 3R, now available, are water soluble compounds which display a blue or blue-white fluorescence when applied to cellulosic materials. These compounds transform part of the invisible ultra-violet rays to visible light rays, which, when added to the normal visible light rays, give added brightness to a white fabric.

Calcofluor White B and Calcofluor White 3R are substantive on cellulosic fibers, and are suggested for production of better whites or for whiter grounds in prints.

Consult your Calco representative for information and samples of the Calcofluor Whites.

New Printing Powders for Cottons

Calconyl* Powders are the powder form of Calconyl Double Solution, recently announced. These powders are stabilized azoic dyes for printing and are from 2¼ to 2½ times the concentration of Calconyl Double Solutions, highly recommended for mills preferring to use powders.

Calconyl Powders are suitable especially for printing on cotton to produce full shades with good fastness to light, washing, dry cleaning, hot pressing and perspiration. They are adapted to printing dress goods, table cloths, handkerchiefs and towels.

Calconyl Powders offer great ease in handling and a high degree of stability in storage.

Calconyl Yellow 2GR Powder
Calconyl Yellow G Powder
Calconyl Golden Yellow R Powder
Calconyl Scarlet R Powder
Calconyl Red G Powder
Calconyl Red R Powder

Dyeing U. S. Army Necktie Cloth

The United States Army necktie cloth dyed in the dark shade of O.D. 51 is made up with a cotton warp and a mohair filling. The cotton is being dyed in the raw-stock form in some mills, and in yarn form in package machines by other suppliers. Vat dyes are specified for the cotton, and chrome dyes are being used to obtain the required fastness properties when cross dyeing the mohair in the finished piece.

The pieces containing the vat dyed warp are usually dyed on the jig in the flat or open width to retain the required picks per inch in the finished cloth. The cutter thus obtains the maximum amount of cloth for ties and curling of the cut necktie is prevented.

Government specifications require good fastness to light, laundering, perspiration and crocking.

The following Calcochrome* dyes and Vat dyes produce successful runs on this shade.

Calcochrome Dyes

Calcochrome Brown EB
Calcochrome Alizarine Blue Black B
Calcochrome Yellow G

Vat Dyes

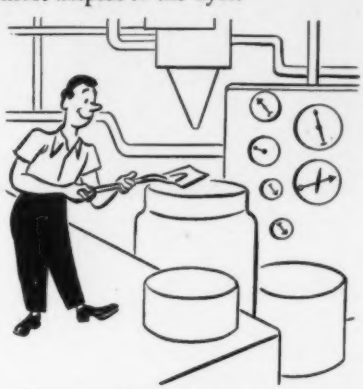
Calcosol* Olive Green BN Double Paste
Calcoloid* Black BBD Double Paste
Calcosol Brown RR Single Paste
Calcosol Khaki G Paste

Suggested formulae can be supplied upon request. *TRADEMARK

FOR THE TEXTILE BOOKSHELF

Determination of the Solubility of Dyes (Calco Technical Bulletin No. 801)—Discusses the rate of solution, the solubility and methods of increasing the solubility of dyes in many fields of application.

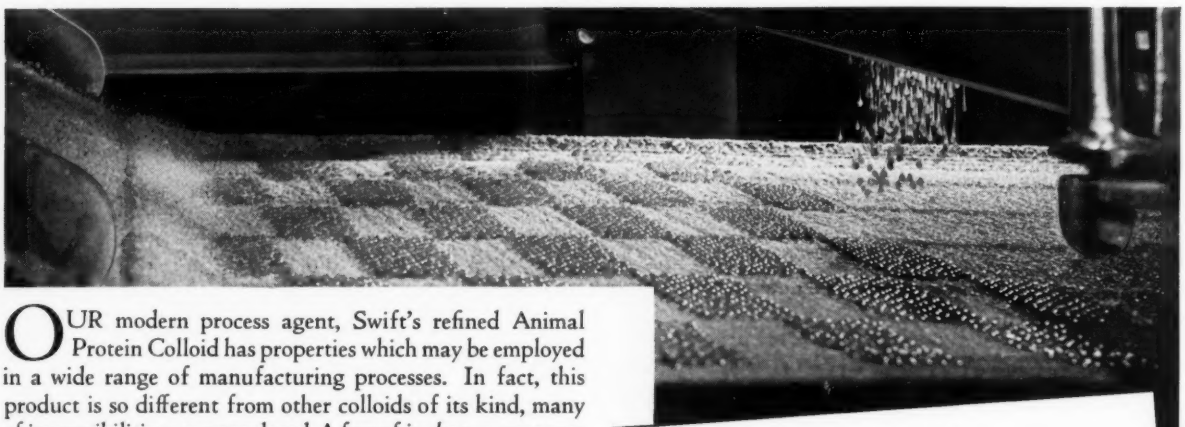
Studies of Nylon Dyeing: Effect of Dyeing Procedures (Calco Technical Bulletin No. 798)—This study endeavors to arrange the laboratory experiments and presentation of the data in a manner which will reveal the progress of the dyeing action that will be most helpful to the dyer.



Five pounds of raw material are used to produce one pound of Calco dye.

You tell us! *What uses can be made of a process agent as clean as...*

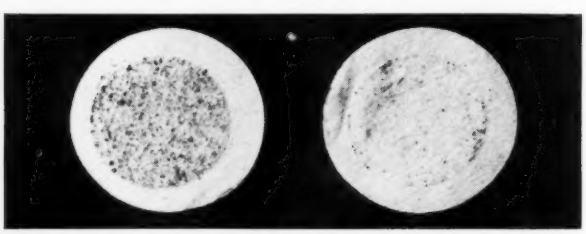
Swift's Animal Protein Colloid*?



OUR modern process agent, Swift's refined Animal Protein Colloid has properties which may be employed in a wide range of manufacturing processes. In fact, this product is so different from other colloids of its kind, many of its possibilities are unexplored. A few of its *known* uses are:

1. An emulsifier
2. A flotation agent
3. A gel structure
4. A settling agent
5. A protective coating
6. A sizing agent
7. A carrier of pigments
8. An impregnating agent
9. A base for pigments
10. An oilproofing agent
11. A flocculating agent
12. A clarifying agent
13. A filtering agent
14. A stiffening agent
15. A mordant
16. An adhesive

...but there may be many *others* of equal value!



Here a filter test indicates the relative cleanliness of this new process agent. Left: Ordinary commercial grade bone glue. Right: Swift's Animal Protein Colloid.

Try it for yourself. We invite you to test the possibilities of Swift's Animal Protein Colloid. It may meet your present requirements or help you to develop new products or more efficient processes.

For further information about Swift's Animal Protein Colloid write: →

What is this modern process agent?

Swift's Animal Protein Colloid is made by an exclusive Swift process. This process makes possible the production of high quality protein colloid of unusual uniformity in particle size and composition.

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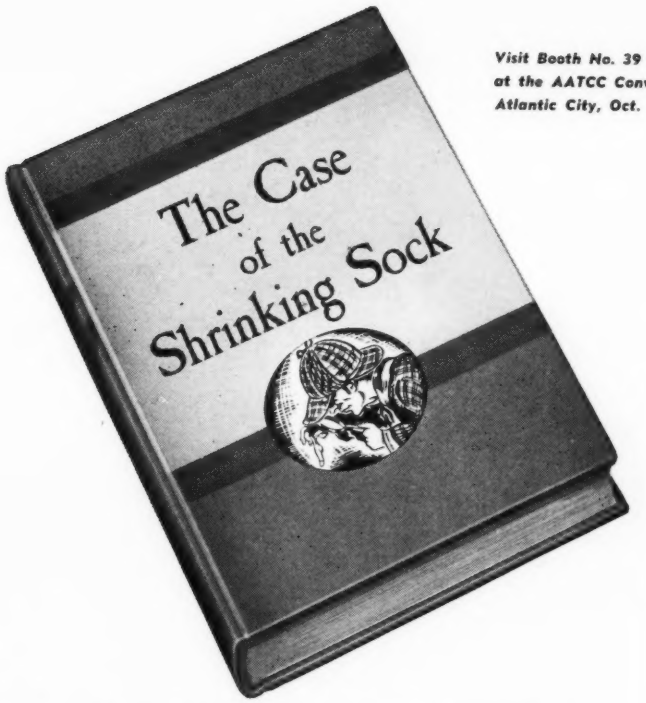

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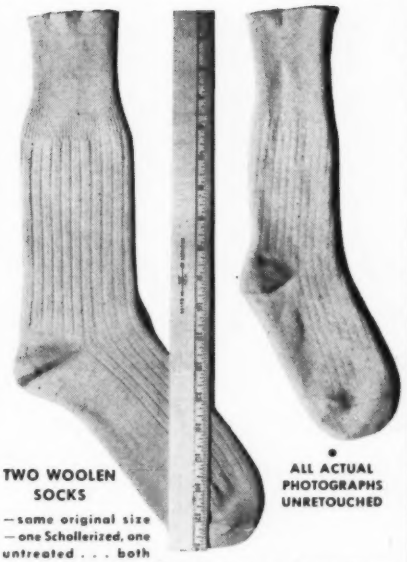

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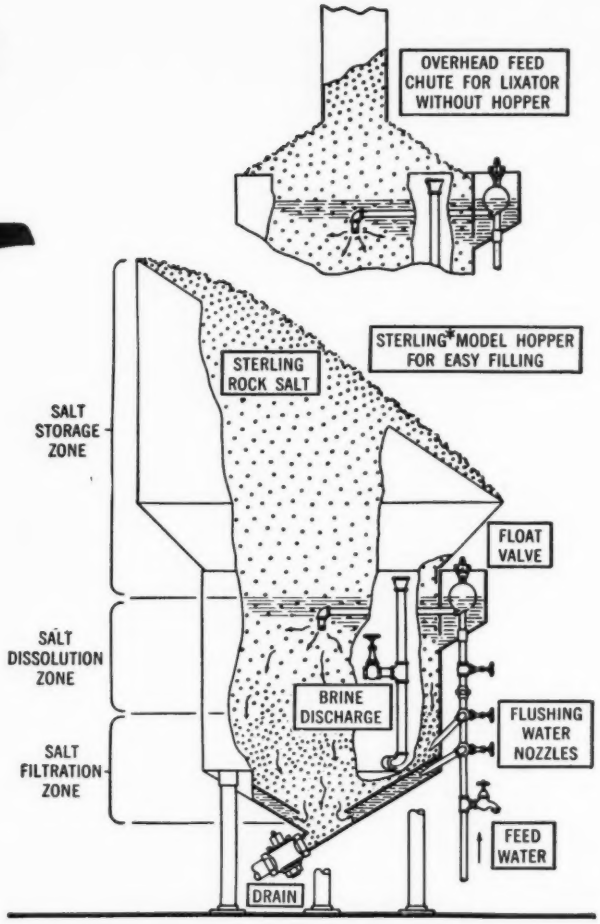

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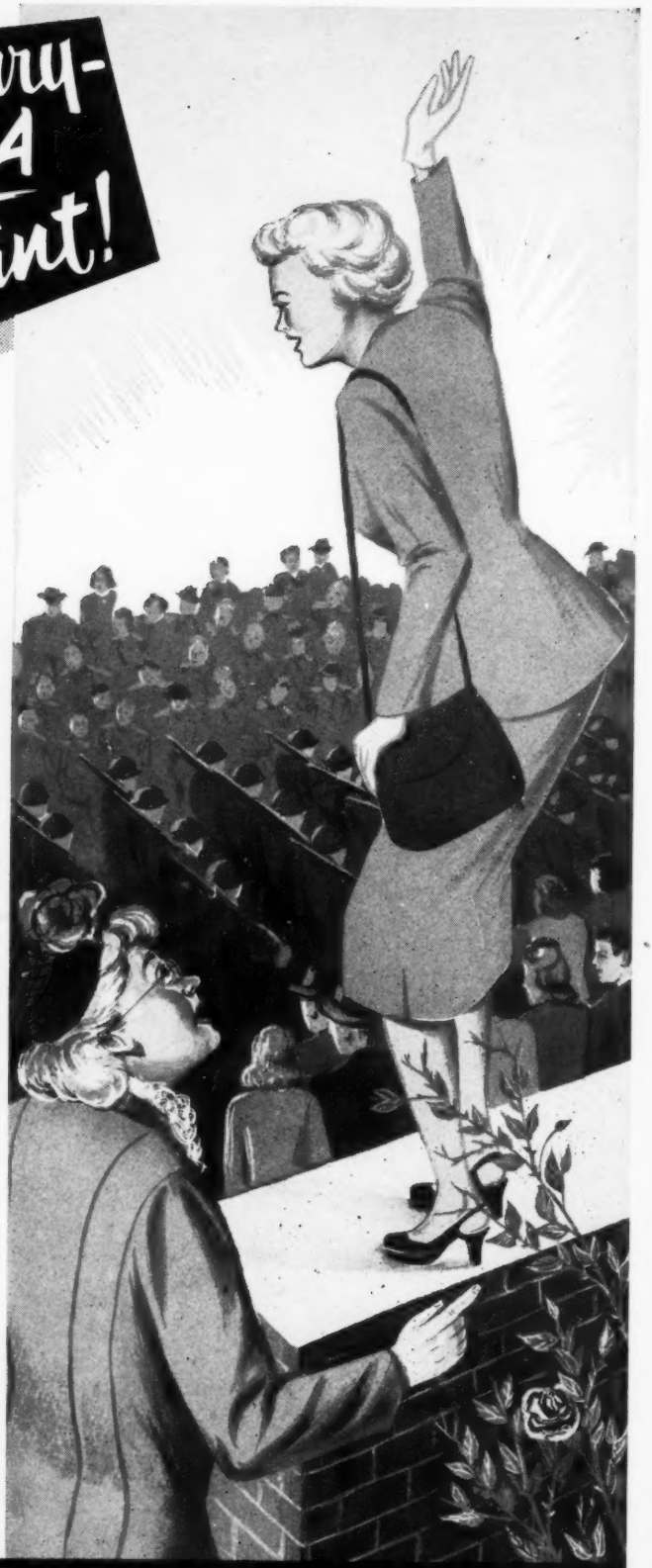

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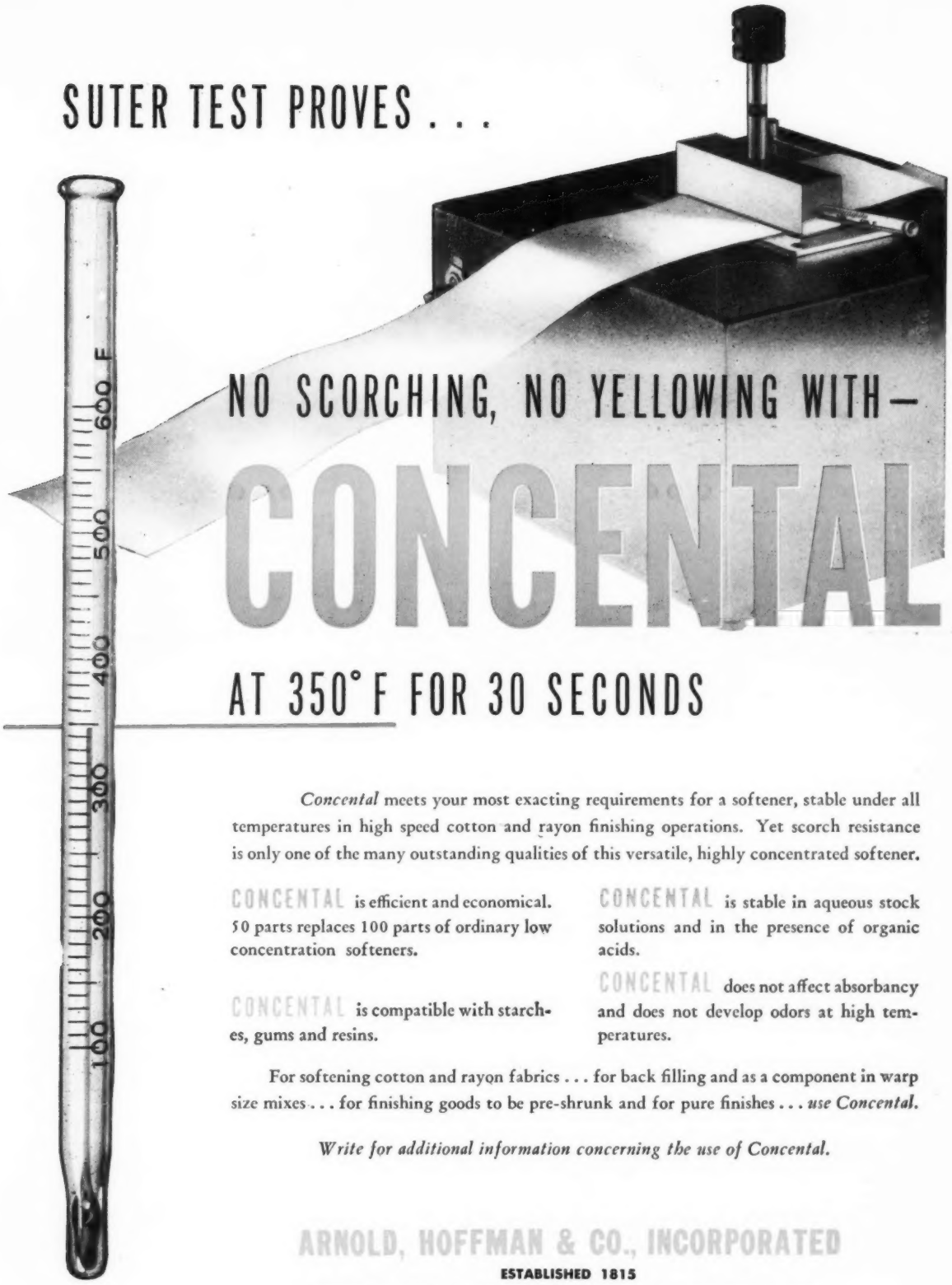

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SEPTEMBER 19, 1949
VOLUME 38 NUMBER 19

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VOLUME 38 September 19, 1949 NUMBER 19

A Fundamental Study of Aging Conditions in the Vat Ager

FREDERICK FAHNOE

Central Research Laboratory,
General Aniline & Film Corporation,
Easton, Pennsylvania

Introduction

THE aging of vat colors is a process which has given erratic and unpredictable results for many years. Very little accurate information is available concerning what happens inside the ager, and the use of vat agers in the industry has become an art rather than a science. It is general knowledge that the performance of agers is subject to a wide variety of variables such as temperature, steam pressure, moisture content of the steam and even the weather. The object of this investigation was a fundamental study of the aging process with a view toward learning the effect of every variable which might conceivably affect that process. It was directed toward the prediction of aging conditions when the status of each of the variables is known. The determination of the proper operating values for each variable has led to recommendations for instrumentation to control the continuous vat ager.

The variables that affect aging according to the literature and our experience were considered:

A. Moisture content of the cloth. *(1, 17, 46.)*
B. Moisture content of the dye paste printed on the cloth. *(5, 28, 33, 24, 46)*
C. Effects of weather and location. *(7, 17, 34, 38)*
   I) Barometric pressure.
   II) Ambient temperature.
   III) Winds or gustiness.
   IV) Relative humidity.
D. Temperature in the ager. *(1, 2, 5, 7, 12, 16, 17, 18, 23, 25, 38, 39, 46, 28)*
E. Steam quality in the ager. *(7, 16, 18, 24, 23, 32, 33, 34, 36, 42, 43, 46)*
F. Air content of the ager atmosphere. *(2, 16, 17, 25, 32, 33, 38, 39, 40, 46)*
G. Steam flow rate. *(1, 12, 16, 21, 28, 33, 42, 46, 47)*
H. Steam distribution in the ager. *(1, 2, 7, 16, 17, 24, 38, 42)*
I. Characteristics of various dyestuffs and pastes.
J. Characteristics of various cloths.
K. Rate of feed of cloth into the ager. *(2, 6, 16, 25, 26, 38, 47)*
L. Amount of dyestuff on the printed cloth.

To reduce the number of variables in the study, the major portion of this work was done with the following standardized conditions:

a) The agers employed were not altered internally so that the steam distribution remained consistent.
b) Vat type dyes were employed, (Table I) printed according to standard formula (10 per cent dye paste, 90 per cent PR thickener) (Table II) on 80x80 cotton cloth.
c) The cloth feed rate was kept uniform at 11 or 28 feet per minute.

With these considerations the first seven variables listed above remain as the principal interest of this work although some work was done on the last four phases and will be reported at the conclusion.

Theoretical Discussion of Process Mechanism

Prior to a study of the effect variables upon the aging process a hypothetical picture of the process mechanism was evolved to give some basis for comparison of the experimental results. *(1, 2, 5, 8, 11, 12, 17, 24, 27, 38, 39, 46, 47)*

In the major portion of vat printing and aging the cotton cloth is printed with a dye paste which contains the oxidized or quinone form of this dyestuff combined with a paste (in this case PR thickener),

TABLE I

	Colour Index No.
Indanthrene Brill Pink RAM Superfix	Pr. 109
Indanthrene Blue GCDS Double Paste Fine	1112
Indanthrene Brown RRA Extra Paste Fine	Pr. 221
Indanthrene Blue BD Suprafix	1113
Indanthrene Olive Green BA Paste for Printing	Pr. 293
Algol Orange RFA Suprafix	1217
Algol Yellow GCA Paste Fine	Pr. 9
Indanthrene Red FFBA Double Paste Fine	Pr. 296
Indanthrene Brill Orange RKA Paste for Printing	Pr. 116
Indanthrene Brill Green B Double Paste Fine	None

TABLE II

Potash-Rongalite (PR) thickener composition

	Per cent
Rongalite C	7.5
Glycerine	7.5
Wheat Starch	8.5
Caustic Gum	15.0
Potassium Carbonate	14.7
Water	46.8

containing spreading agents such as gum and starch, a reducing agent such as Rongalite, a basic ingredient, potassium carbonate, a humectant, glycerine, and water. The resultant print is then dried and passed into the vat ager where the following processes occur: *(1, 12, 24, 46)*

1. Absorption of water from the steam atmosphere to form a solution of the ingredients of the dye paste.
2. Decomposition of Rongalite to active reducing agents when solution is obtained.
3. Reduction of the dyestuff to a more soluble leuco form.
4. Absorption or adsorption by the cloth of dissolved leucodye via solution.

After passing from the ager, the print is oxidized to place the dyestuff in the insoluble quinone form and soaped to remove the other materials of the paste, rinsed and dried.

The processes mentioned here may by their nature cause extraneous effects which may affect one another for better or worse, and in actual commercial operation may alter one or more of the determinant variables. An example which is reported in literature *(1, 5, 27, 33, 39, 46)* and experimentally confirmed, is the increase in print temperature above ambient steam temperature due to adsorption and solution of the dye paste ingredients. This generated heat can elevate the temperature of the surrounding steam under certain conditions. *(1, 5, 17, 27)*

Fortunately, some pure research work has been done on some of the aspects of the aging process which permits some insight into the behavior of these individual processes. Where it was lacking, supplemental experimental data have been obtained. Meggy *(27)* has studied the boiling point data of solutions of the print paste ingredients and found that only potassium carbonate, Rongalite and glycerine elevate the boiling point. Taking his data for an analysis corresponding to PR thickener a temperature-concentration curve such as is shown in Figure 1 is obtained. As an example, a solution containing 60 per cent of these ingredients boils under atmospheric pressure at 239°F. If a dried print be introduced into steam in the ager, steam will condense on the print bringing the print up to steam temperature. The amount of steam necessary to do this is about 6 per cent of the weight of the print. To get sufficient water to form a saturated solution on Meggy's

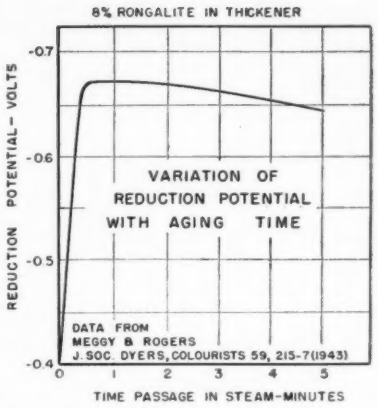


Figure 2

curve (79 per cent) would require condensation of steam to the amount of 5 per cent of the weight of the print. Actually by experimental weight analyses, steam to the extent of 14 to 17 per cent of the weight of the print is condensed in two minutes in a steam ager and 15 to 20 per cent of the weight of the print in five minutes with little change for more pro-

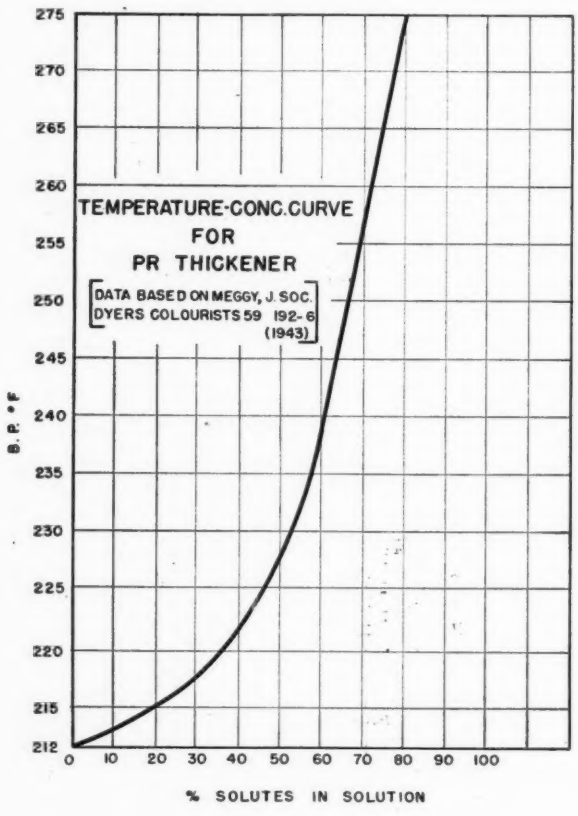


Figure 1

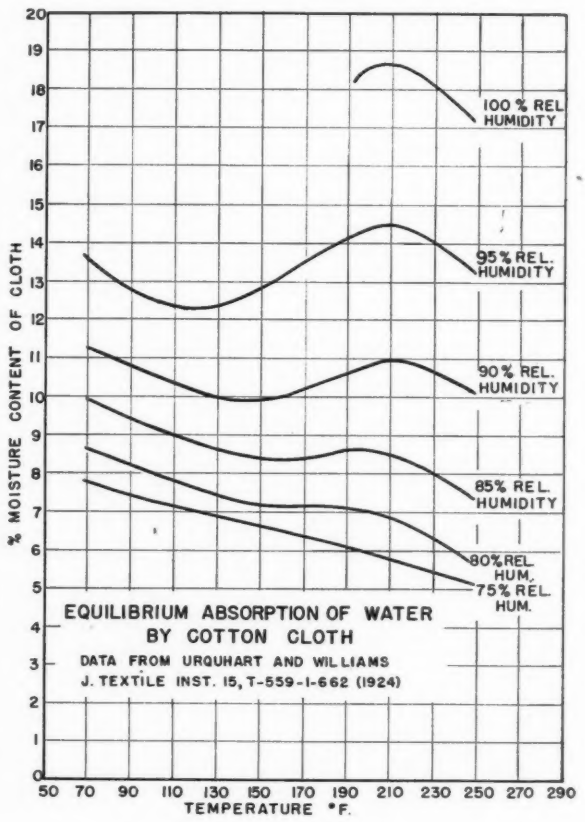


Figure 3

longed aging. Thus, it would appear that the solution temperature of the print would tend to initially approach a maximum value of 275°F. as shown on Meggy's curve, and then fall off with subsequent condensation and dilution. Experimentally, measurement of the temperature of the print in aging bears this trend out (Figure 7). Combining this information with weight analyses, it may be concluded that the solution of the ingredients of the dye paste by adsorption of water from the steam begins rapidly (15 to 30 seconds) after entrance into the steam atmosphere of the ager and is capable of evolving a large amount of heat capable of raising the temperature of printed cloth considerably above that of the steam atmosphere. Thus the conditions of solution essential for the necessary chemical reactions are quickly obtained.

The rate and extent of Rongalite decomposition can best be studied by measuring the reduction potential of the print in actual aging. Meggy and Rogers *(27A)* have provided a method of measuring this potential which has been duplicated using PR thickener alone. It will be observed that their plot of reduction potential of the print as a function of time in the steam atmosphere (Figure 2) shows that the maximum potential of the system is reached simultaneously with initial solution and falls only slightly during subsequent steaming. They have also shown that the reduction potential is quite independent of Rongalite concentration within wide limits.

The rate of reduction of the dyestuff to the more soluble leuco or hydroquinone form is principally dependent upon the reduction potential of the Rongalite. Reduction of the dye begins as soon as the reduction potential of Rongalite reaches its initial high value. It is believed that various vat dyes have different potential values at which the reaction quinone to hydroquinone proceeds, *(2A)* although such redox potential values at steam temperature have not been determined at the present time. Accordingly, a dye with a redox potential close to that of Rongalite in the paste in aging will reduce more slowly than one with a lower redox potential. Hence, any factor which tends to lower the reduction potential of the print paste will affect the rate and extent of reduction of the dyestuff and correspondingly the amount of dye absorbed by the cloth.

Experimental evidence for this view has been obtained. The introduction of 2 per cent air into the steam will lower the measured reduction potential of PR thickener very substantially (i.e., in the order of 100 to 200 mv); corresponding to this condition different vat dyes have exhibited varying losses in print strength, all, however, of considerable magnitude.

The process whereby the leuco form of the dye is absorbed on the cloth fibers is not well understood. Certainly, one of the dominant factors is the amount of absorption of the leuco-containing solution which under aging conditions can be made by cotton *(8, 20, 21, 22, 45, 46)*. The equilibrium absorption data of water on cotton under steaming conditions has been obtained by Urquhart and Williams *(45)* and Keating and Scott *(22A)*—Figure 3. It will be noted that the equilibrium amount of absorption is very greatly affected by the air content at temperatures around 212°F. and less so by increases in steam temperatures above 212°F. Studies of absorption of water by cotton cloth in the steam atmosphere of the ager indicate that in five minutes a value of 60% of equilibrium, or 11% by weight, is obtained, this value being independent of the initial moisture content of the cloth. Thus, a dry cotton cloth of initial moisture content of 0% would absorb 11% by weight water, while a damp cloth of 8% initial moisture content would absorb only 3% by weight of water. Cloth of initial moisture content above 8% showed a uniform increase of 3% by weight of water in five-minute aging. It has been noted that this moisture absorption is accompanied by a temperature rise of the cloth (Figure 4), the magnitude being inversely proportional to the initial moisture content of the cloth. Absorption by the cloth as measured by the temperature effect is a uniform process continuing throughout aging, and in aging a vat print is a contributing cause to elevation of the print temperature.

The Study of the Effect of Individual Variables

The problem was approached with the concept of observing the effect of each single variable upon the print strength of the aged vat print while holding the balance of the variables constant. For convenience the results have been judged by print strength alone.

The two major pieces of equipment employed are shown in Figures 5 and 6. The small experimental ager was constructed to obtain very standard and reproducible conditions using small print samples. Provisions for super-heating steam, adding known amounts of air or moisture, etc., were made as shown.

The large ager is a 100 cu. ft. Butterworth laboratory ager, to which a tight cloth gate has been added. Facilities for metering the steam supplied and the condensate collected are present. Lead jacketed iron-constantan thermocouples were inserted as shown. An automatic stack damper control actuated by the ager internal pressure is also present. This ager was employed to age larger samples to obtain cumulative effects as well as to check the data obtained using the experimental ager. The modifications installed for continuous instrumentation and control are described later.

Initial Moisture Content of the Cloth

It has been postulated that the initial moisture content of the cloth might have a detrimental effect on the amount of dye absorbed during aging, and thus the print strength. Since the print paste is always

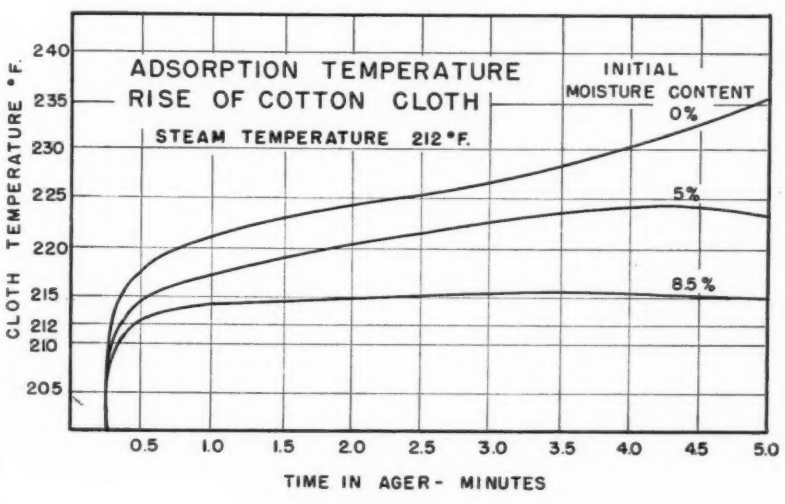


Figure 4

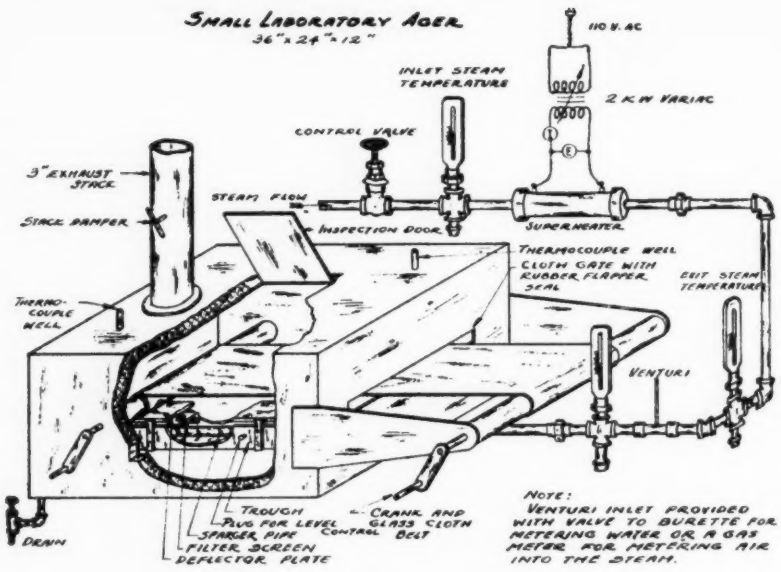
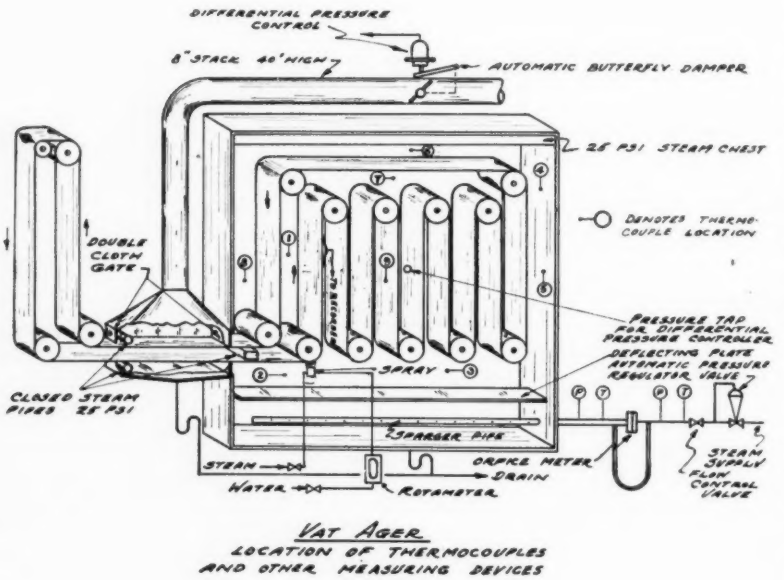


Figure 5

present on the cloth in normal practice, any treatment of the print subsequent to printing and prior to aging would affect both cloth and print paste and accordingly not permit separate evaluation of the effect of the moisture content of the cloth alone. To avoid this, cotton cloth of various initial moisture contents were prepared by equilibrium exposure to controlled humidity atmospheres, then immediately printed with standard print paste and aged without drying under uniform aging conditions. It was experimentally determined that as the initial moisture content of the cloth increased from 0 to 10% by weight (dry basis) a loss of 10 to 15% in print strength was obtained. A further increase to 15% by weight caused a loss of 20 to 30% in print strength. It should be noted that a cloth of 15% initial moisture content contains more water than a cloth in equilibrium with a 100% relative humidity



VAT AGER
LOCATION OF THERMOCOUPLES AND OTHER MEASURING DEVICES

Figure 6

atmosphere at room temperature. It was experimentally found that cotton cloth containing over 15% by weight of moisture could not be printed properly so values at higher ranges were not obtained.

In normal practice prints are dried after printing; the presence of water in the print can thus occur only by incomplete drying or by exposure to a humid atmosphere in the storage period between drying and aging. Since the storage period is a variable, some knowledge of the rate of absorption of water by cloth may be of interest. The rates of absorption of water by cotton cloth in atmospheres of different relative humidities and temperatures have been variously reported. *(27A, 49)* A convenient rule of thumb is to consider that in twenty-four hours 60% of equilibrium, as determined by the Urquhart and Williams data *(45)*, will be attained.

Initial Moisture Content of the Dye Paste

The separation of the effect of the initial moisture content of the dye paste from the effect of the initial moisture content of the cloth upon the resultant aged print strength is difficult. The effect of the initial moisture content of the paste was studied by printing standard print paste containing 20% by weight of water on dry cotton cloth and quickly drying the resulting print to various moisture contents between 20 and 0% and immediately aging. It was found that the degree of dye penetration into the cloth decreased directly with the reduction in moisture content of the paste although the aged print strength was virtually unaffected. It was observed that the gain in moisture content of the prints in five-minute aging was constant at about 10% for all values of initial moisture content of the dye paste between 20 and 10% but the gain in moisture content on aging increased to 20% as the initial moisture content of the dye paste was further reduced to 0%. Temperatures of the prints during aging were obtained (Figure 7). It can be noted that as the initial moisture content of the paste decreased more of the water supplied to the print came as water of condensation of the steam. As this occurs progressively more heat is liberated raising the print temperature; the dry print yielding the highest print temperature.

Some mention of the staying qualities of prints of varying degrees of moisture content should be noted. It was found that a vat dye paste of 20% initial moisture content (as printed condition) could remain in contact with the cloth as long as one hour without a resultant loss in print strength of the aged material. A gradual loss of print strength was noticeable after an hour's storage; in about twenty-four hours a 50% loss was usual.

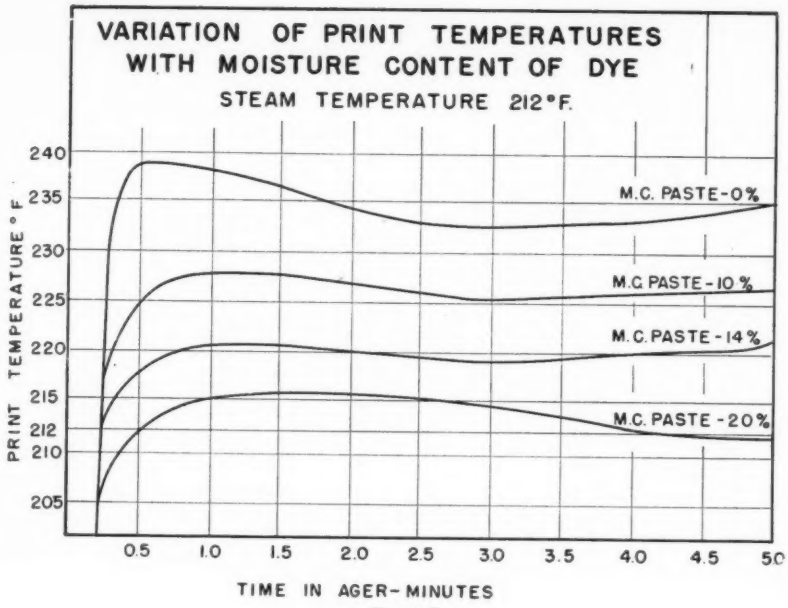


Figure 7

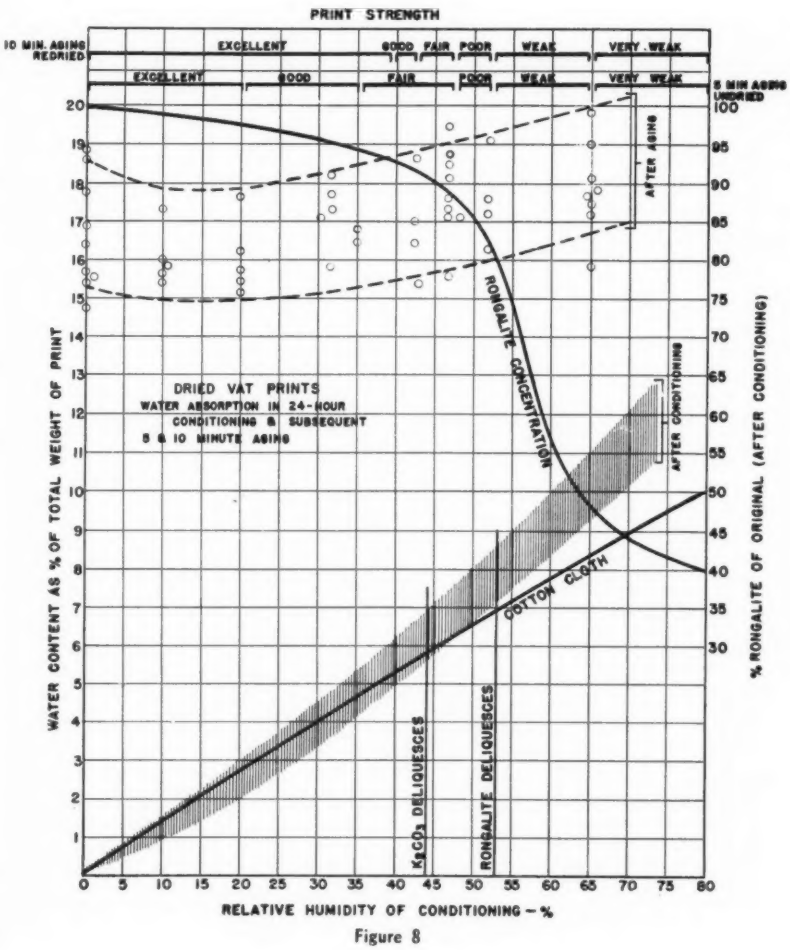


Figure 8

Relative Humidity

The effect of relative humidity of the atmosphere is closely related to the two effects just mentioned. Its principal effect is on the print prior to aging; no effect having been noted upon the operation of the ager itself. Standard dried vat prints were placed in atmospheres of various relative humidities for periods up to 72 hours and aged. The resultant data is plotted on Figure 8. The initial moisture content of the prints reached equilibrium values in about 24 hours of such conditioning. These were found to increase rather uniformly with relative humidity. They closely parallel the equilibrium absorption values for plain cotton cloth. The moisture content of the conditioned print after aging shows some variations in the range of 15 to 20%. The difference between the two curves is the absorption of moisture taking place in the ager. It was expected from the study of the effect of initial moisture content of cloth and dye paste that a uniform decline of the aged print strength would be obtained as the amount of absorption taking place in conditioning increased. It was noted, however, that at the relative humidity corresponding to the deliquescence points of potassium carbonate (44%) and Rongalite (53%), a very sharp break in print strength occurred. Analyses of the conditioned prints indicated that at these points a rapid deterioration of Rongalite had occurred. Further experimental work led to the conclusion that these phenomena occur when a dried vat print is placed in a humid atmosphere prior to aging:

1. Absorption of water by the cloth itself, raising its initial moisture content with a consequent reduction in absorption in aging noted as a reduction in the ultimate print strength.
2. Absorption of water by the dye paste itself. The soluble ingredients tend to form a solution and the migration of this solution into the cloth prior to aging seriously impairs dye absorption by the cloth, and alters the concentration of active ingredients in the paste. The deleterious effect of migration upon the aged print strength is, however, not entirely due to reduced concentration effects in the dye paste since it cannot be corrected by re-introducing Rongalite and carbonate to the paste. Once initiated, the detrimental effect of migration upon print strength cannot be corrected by redrying the print, increased aging time, or adding additional Rongalite.

3. Slight decomposition in the order of 0 to 10% of the Rongalite present in the paste occurs as the relative humidity increases from 0 to 45%. It was found that this amount is insufficient by itself to affect the print strength. The rapid decomposition of the Rongalite of the print occurring above the deliquescence point of potassium carbonate results in a very pronounced reduction in print strength.

Summing up the practical conclusions of this phase from a time basis:

A. When the relative humidity of the surrounding atmosphere is less than 30% vat prints may be stored prior to aging as long as twenty-four hours without loss of print strength.

B. When the relative humidity is greater than 30% but below 45% prints may be stored twenty-four hours expecting at worst a 10 to 20% loss in print strength. This loss may be eliminated by redrying the print prior to aging and subjecting it to a longer aging period.

C. Above 45% relative humidity even short periods of storage, two hours or more, will necessitate loss of print strength in aging. This loss cannot be restored regardless of subsequent treatment.

Temperature in the Ager

The effect of the temperature of the steam in the ager was studied by introducing standard dried vat prints into super heated steam. The effect (Figure 9) can be readily seen. A convenient rule of thumb is that for each 14°F. rise in steam temperature, a 10% maximum loss in print strength is obtained in five-minute aging. It will be noted that as soon as the print sample tended to become dry further increase in print strength was arrested and the prints actually emerged in a dry reduced form. A record of the print temperatures during aging was made (Figure 10). The curve of print temperatures in 212°F. steam is similar to that for a dried print in Figure 7. The initial temperature rise and following descent has been established as a measure of the rate of formation of solution of the dye paste on the print. The upward rise after this descent is a measure of the rate of evaporation of water from the print. The point of flexure represents the end of the absorption period. At any time after this point no change in aged print strength can be noted. From an inspection of the magnitude of the initial rise, it may be concluded that the reaction rates and rate of water absorption by the print are accelerated by an increase in the ambient steam temperature. Opposing this trend is a sharp reduction of the time period in which absorption by the cloth can occur as the steam temperature increases. The net result indicated by Figure 9 is a decrease in the total absorption by the print with increasing temperature for any given time period with a corresponding reduction in print strength. As a contrast if the print dye paste contained initially 20% by weight of water (as printed, undried) it exhibited no loss in print strength in aging at steam temperatures from 212 to 266°F. and furthermore it exhibited little or no tendency for an initial temperature rise due to absorption effects. This is mentioned here because it is believed that the increase in steam temperature which occurs in a steam ager supplied with saturated (212°F.) steam is due to the cumulative effect of the heats of solution and absorption of water which must be condensed from the steam in the case of a large quantity of dry print goods. The print temperatures are a measure of this evolved heat. If this water is supplied as a liquid, no rise of the print temperature above that of the steam is discernible. If, however, this generated heat is not removed a gradual super-heating of the ambient steam will occur giving rise to effects noted above.

Steam Quality in the Ager

To investigate the effect of steam quality upon aging, synthetic steam atmospheres were prepared in which liquid water was introduced as an atomized mist. Steam of 0 to 5% quality was prepared and studied; quality was expressed as weight of liquid water dispersed per unit weight of saturated steam at 212°F. Vat prints showed absolutely no change in print strength through this variation. Above 5% quality, the dispersed mist became so thick that droplet formation ensued which caused feathering of the prints.

Air Content of the Ager Atmosphere

To investigate the effect of the air content of the steam on the strength of vat aged prints, air was introduced into the ager at a measured rate into a known steam flow at 212°F. For five-minute aging it was found that the maximum air content which would not affect the print strength of vat prints was 0.3%. As the air content of the steam increased to 1% the aged print strength fell off as much as 50%. The dyes employed were not uniform in their reaction to equal air contamination. Some dyes, such as Indanthrene Brilliant Pink RAM and Indanthrene Brown RRA were quite sensitive, and others such as the Indanthrene Blues less sensitive. It is believed that this variation in sensitivity is a function of the oxidation-reduction potential of the individual dye. It has been experimentally demonstrated that the reduction potential of PR thickener itself is severely lowered by 1% of air in the steam atmosphere of the ager. The limiting air content of the steam in any portion of a steam ager may safely be given as 0.3% if detrimental losses in print strength are to be avoided.

Knowing the detrimental effect of such minute amounts of air, it can be readily appreciated that avoidance of air leakage into the ager becomes a matter of paramount importance. In an effort to find some method which would permit accurate determination of the air content in any portion of a steam ager, the probing

AGING OF DRY PRINTS IN SUPERHEATED STEAM

VARIATION OF PRINT STRENGTH AND VISIBLE MOISTURE CONTENT WITH TIME AND TEMPERATURE

AGING TIME	STEAM TEMPERATURE °F.				
	212	226	239	252	266
30 SEC.	VERY WEAK	WEAK	WEAK	VERY WEAK	VERY WEAK
1 MIN.	WEAK	POOR	WEAK	VERY WEAK	VERY WEAK
2 MIN.	FAIR	GOOD	FAIR	POOR	WEAK
3 MIN.	GOOD	GOOD	FAIR	POOR	WEAK
4 MIN.	EXCELLENT	GOOD	FAIR	POOR	WEAK
8 MIN.	EXCELLENT	GOOD	FAIR	POOR	WEAK
15 MIN.	EXCELLENT				

NOTE:
ALL SAMPLES BELOW HEAVY LINE WERE DRY TO TOUCH UPON EXIT FROM AGER

Figure 9

device illustrated in Figure 11 was developed. The principle of the probe is based upon Meggy's discovery *(27A)* that the reduction potential of print paste itself was affected by the presence of air. A sample calibration curve (shown on Figure 12) and was found to be very reproducible. It will be noted that the device has excellent sensitivity in the desired range (0-2% air) for which no commercially available instrument is satisfactory. The utilization of this probe should permit a study of the steam distribution in any ager to locate stagnant areas and determine the desirable location of baffles, etc.

The most desirable means of maintaining an atmosphere in the ager which would be free from air would be to maintain a positive pressure in the ager. To this end an automatic stack damper control was installed in the exhaust stack of the small continuous ager (Figure 6). This damper was controlled by the differential between the internal pressure of the ager and the ambient pressure. It was set to maintain a positive pressure of +0.01" of water in the ager, independent of external barometric pressure and wind conditions. This pressure was sufficient to provide a constant small flow of steam from the cloth gate at all times. This arrangement has avoided all air surging and air contamination. The pressure to be maintained in any ager may vary slightly according to location, stack diameter, stack height, size of cloth gate, etc.; but once determined, it should remain a constant value. The probe described above provided a convenient method of determining the correct operating point. Steam temperatures at numerous points within the ager have remained constant day after day over a year's trial period. The ager has been operative every day since the installation regardless of weather, and aging results have been very reproducible.

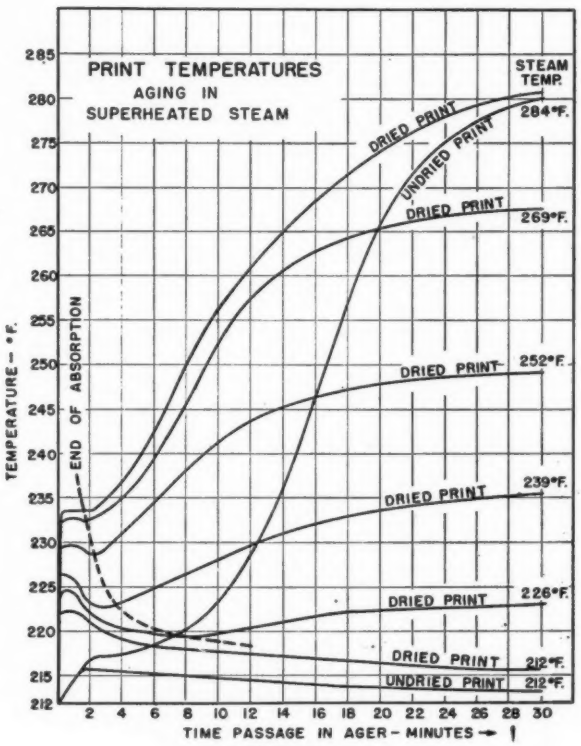


Figure 10

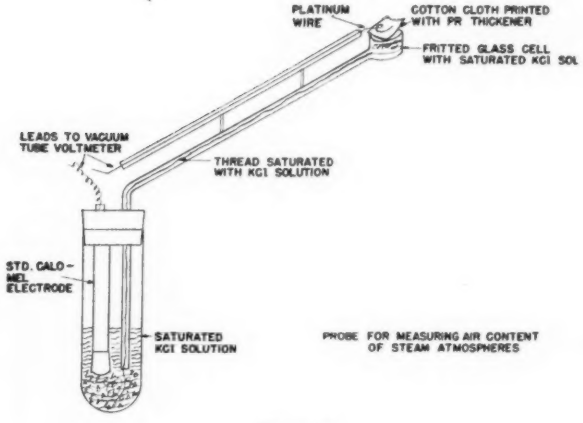

PLATINUM WIRE
COTTON CLOTH PRINTED WITH PR THICKENER
FRITTED GLASS CELL WITH SATURATED KCl SOL
LEADS TO VACUUM TUBE VOLTMETER
THREAD SATURATED WITH KCl SOLUTION
STD. CALOMEL ELECTRODE
SATURATED KCl SOLUTION
PROBE FOR MEASURING AIR CONTENT OF STEAM ATMOSPHERES

Figure 11

Steam Flow Rate

The last variable investigated was the effect of steam flow rate. In the 100 cu. ft. laboratory ager the steam flow was varied from 75 to 400 lbs. per hour with no effect on print strength. Below a flow of 75 lbs. per hour, a positive pressure could not be maintained within the ager and air seepage occurred; at all flows greater than this, the automatic stack damper control assumed and maintained control. The print temperatures in aging are reduced by an increase in steam flow through the ager (Figure 13). This is directly a measure of the removal of the heat generated on the print by the process of solution and absorption. Since relatively little lowering of the print temperature is occasioned by a five-fold steam increase, it seems advisable for economy reasons to operate the ager only at a steam flow sufficient to keep the automatic stack control operative (i.e., in the 100 cu. ft. capacity experimental ager, 100 lbs. per hour) and seek some other method of reducing super heating caused by the reactions of the vat print.

Study of Other Type Dyes Used in Steam Agers

In addition to the vat type dyes with which the above discussion has been concerned, Algosol* and Rapidogen* type dyes are often printed for aging in the steam ager.

The Algosols are stabilized soluble leuco ester dyes and are printed as such together with a soluble source of hydrogen ions or 'acid-splitter' and a soluble oxidizing agent. No reduction takes place in the ager; instead the stabilizing groups are split off the soluble dye molecule by hydrogen ions at steam temperatures and the resultant leuco dye is oxidized by the oxidizing agent present in the paste.

The Rapidogen dye paste for neutral steam aging consists essentially of a stabilized diazo amino compound, combined

* Trade Mark Reg. U. S. Pat. Off.

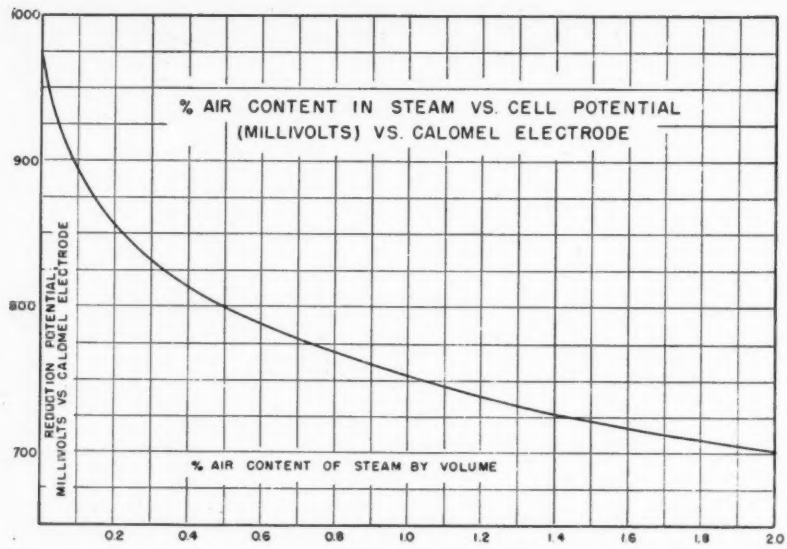


Figure 12

with a naphthol and a volatile basic constituent. All the active components of the paste are soluble. In the steam atmosphere of the ager the basic constituent is volatilized and the naphthol decomposes the diazo-amino complex and couples with the liberated diazo compound to form the azo pigment dye.

Two fundamental differences exist between these dyes and the vat types previously discussed:

1. All the active components in the printed paste are water soluble.
2. The chemical reactions involved are essentially unaffected by oxygen.

The variable factors which affected the vat dyes were employed in testing the behavior of these two dye types. The following dyes were used and, in each case, printed according to specification:

Algosol	*Rapidogen*
Blue IBC	Blue BN
Blue O4B	Orange R
Olive Green IB	Red Violet RRA
Brill. Violet I4R	Violet B
Green IBW	Red FFG
Golden Yellow IGK	Red FFR
Brown IBR	Scarlet FFG
Pink IR Supra	Scarlet FFR

The experimental evidence showed that these type dyes were unaffected by storage in atmospheres of all relative humidities from 0 to 100%, were unaffected by superheated steam in the ager from 212 to 284°F. and were unaffected by the presence of as much as 2.0% air in the steam atmosphere of the ager. These results bear out the two fundamental differences between these dyes and vat type dyes. The principal loss of print strength of vat prints in aging caused by the high humidity in storage after printing is due to the migration and separation of the soluble print paste ingredients from the insoluble dye. In the case of Algosol and Rapidogen dyes, all ingredients are soluble and any migration prior to aging would have no segregating effect. The effect of air contamination in vat print aging is toward upsetting the reduction equilibrium; with the Algosol and Rapidogen dyes, the essential reactions are not a reduction type and equivalent amounts of air cause no loss of print strength. It is possible that if the air content were higher the loss of absorption potential of the cloth might cause some loss of print strength, though this conjecture has not been experimentally demonstrated. The fact that these dyes in aging were unaffected by even 284°F. superheated steam indicates that the reaction rates of these dyes in aging must be extremely rapid in comparison with the reduction of a vat dye to the leuco form. At steam temperatures of 284°F. the absorption process is arrested in about two minutes of aging and yet full strength prints were obtained.

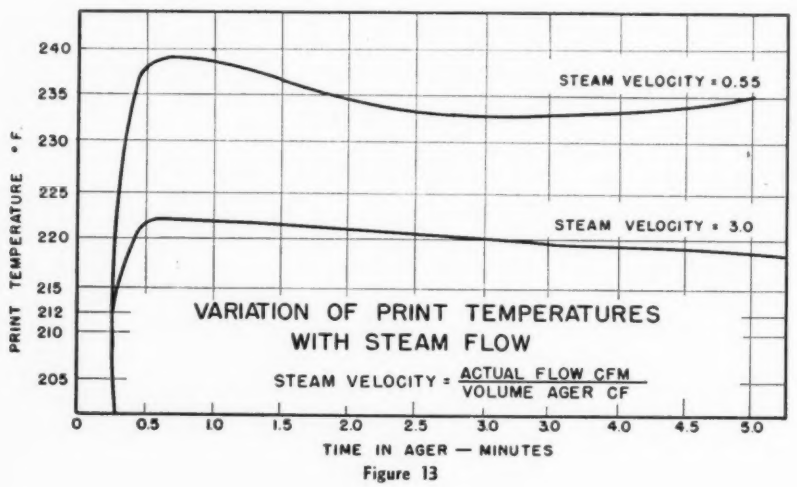


Figure 13

Instrumentation of the Continuous Vat Ager

The foregoing discussion has been concerned with observing the effect of single variables on the aging process. The experimental evidence indicated that, if these optimum conditions of each variable can be maintained constant in a steam ager, uniform prints of high quality will result. In summary, the desired conditions are as listed in table III.

The experimental work following describes the adaptation of the small continuous laboratory ager (Figure 6) on a quasi-commercial scale to obtain data useful for the instrumentation of steam agers in general. As an approach to this end the ager was set up to determine means of obtaining the constant optimum conditons stated in table III. Commercial operation of continuous print aging, however, introduces several conditions which were not obtained in the small scale experimental work described before. The following are listed as those conditions which would differ:

1. The introduction of a continuous print at high speeds might tend to introduce more entrained air than would normal operation of the laboratory ager. *(2, 17, 38)*
2. The continuous introduction of large amounts of printed goods would tend to increase ager steam temperature from beginning to the end of a run due to cumulative solution and absorption heats which are not easily removed. This variation in ager

TABLE III

Variable	Operating Value
1. Moisture content of the print prior to aging.	0%
2. Relative humidity of surrounding atmosphere in interval between printing and aging.	35% or less
3. Steam temperature within ager.	212°F. (max. 217°F.)
4. Steam quality within ager.	No effect below 5%
5. Air content of ager steam.	0.3% maximum
6. Atmospheric effects.	Compensated by stack pressure control.
7. Steam flow rate.	Sufficient to maintain positive pressure in ager

steam temperature does affect the ultimate print strength. *(5, 33, 38, 28)*

3. The introduction of a continuous print per se would entail greater steam consumption due to a greater mass of reactive paste and dry cloth encountered.

From the experimental evidence obtained, the following control methods suggest themselves:

A. REGULATION OF THE AIR CONTENT OF THE AGER ATMOSPHERE—Regulation of the air content of the ager atmosphere has been experimentally shown to be easily controlled by using an automatic stack damper control to maintain a positive pressure within the ager and by maintaining sufficient steam flow to the ager to keep it operative. This control was maintained through a wide range of cloth feed rates from 11 to 60 ft. per minute. Probe studies of the air content of the ager indicated that the minimum steam flow to keep the automatic stack damper control operative not only resulted in negligible interference from air contamination, but also assured a large degree of turbulence within the ager conducive to good steam distribution.

B. REGULATION OF THE STEAM TEMPERATURE IN THE AGER—It has been determined that a dried print increased in weight approximately 20% in five minutes steam aging. This weight increase is due entirely to condensed or absorbed water. Since the dried print prior to entering the ager was at room temperature, a certain amount of steam was condensed on the print in the ager to bring it to steam temperature.

Calculations:

i

Unit weight dry print=1.0#
% Water absorbed in aging=20% (wet basis)
Weight water absorbed in aging=0.25#/# dry print

ii

Room temperature=72°F.; Sp. Heat Print=0.4 Btu/#,°F.
Heat to bring 1# dry print to 212°F.
=0.4x1.0 (212-72)=56 Btu/# dry print
Equivalent to 56/970 or 0.06 # water condensed/# dry print.

The time-temperature curves of a vat print during aging show that the print reaches 212°F. after about 15 seconds exposure to steam in the ager (Figure 7); it may then be assumed that the moisture absorbed due to print preheating (.06 #/# dry print) is added to this time interval. The balance of the moisture obtained by the print in aging is as follows: Weight of water other than preheat (0.25-0.06=0.19 #/# dry print). This heat is absorbed by the cloth and print paste, releasing considerable heat as heat of absorption. This released heat, if not adequately removed, raises the print temperature considerably above the steam temperature. Experimental values of print temperature of 230 to 240°F. have been obtained. Continued passage of new print into the ager thus tends to increase the ambient steam temperature (super heating) with a resultant loss in ultimate print strength. This tendency toward superheating is reduced in present practice by various expedients such as increasing the steam flow through the ager, adding liquid moisture to the steam (increasing the steam quality) and/or by running wet grays. It was felt that if the amount of moisture which was absorbed after preheating (0.19#/# dry print) were added as liquid water by spraying instead of by condensing steam, the source of superheating would be avoided and uniform ambient steam temperature could be maintained in the ager without recourse to increasing the steam flow and other dodges. Laboratory experiments have shown that liquid water applied as spray in the amounts of 0.19 #/# dry print cannot be added prior to entering the ager without puddling on the print, causing a badly feathered aged print. Accordingly, it was felt that the point at which the spray should be applied was within the ager at the time when the print had already reached a temperature of 212°F. and rapid absorption of water by the paste and cloth could be expected. Experiments have shown that if spraying devices were located so as to spray the cloth at a point equivalent to 15 seconds after entry of the cloth into the steam atmosphere of the ager, the calculated amount of water, 0.19#/# dry print, could be added with no deleterious effects to the print. Since the introduction of air into the ager is undesirable, high pressure steam was used as the dispersing agent in the spraying devices with very favorable results. The amount of water to be added to the print as spray should be sufficient to maintain the desired constant steam temperature of 212-217°F. in the ager. Since the print temperature would be a primary factor in determining the steam temperature, it was felt that a print temperature measuring device located past the point of spray application would be the most sensitive method of determining the amount of water spray to be employed. Accordingly, an iron-constantan thermocouple was placed at the focal point of a parabolic reflector facing the print surface at a location some distance past the point of spray application to provide the necessary indication of print temperature. It might be reasonably expected that the weight of cloth and proportion of printed area would affect the amount of water absorbed; this variation can in principle be accommodated by varying the amount of water spray to maintain a fixed print temperature.

C. RATE OF FLOW OF STEAM IN THE AGER.—If this method of maintaining constant optimum ager temperature proves experimentally feasible, variation of steam flow as a controlling factor in holding down the ager temperature is practically ruled out. This would permit use of a constant minimum steam flow sufficient only to maintain positive pressure in the ager and keep the automatic pressure control operative.

The foregoing discussion and experiments resulted in experimental set-up of the laboratory ager as a continuous ager as shown in Figure 6. Experiments were

then performed with the ager operating as a continuous ager to determine if the instrumentation could provide steady state conditions.

The laboratory ager was provided with four Sprayco No. JNP-13 sprayheads located under the first internal roller to spray the incoming print 15 seconds after entrance at a five-minute aging speed. These heads were fed with water whose flow could be regulated with a needle valve and metered with a calibrated rotameter. The dispersing agent was 25 psi saturated steam. The cloth was fed into the ager in such a manner as to present the printed surface toward the spray. Four feet removed from the point of spray application a reflector with focussed iron-constantan themocouple was mounted to give an indication of the print temperature, recording continuously on an Electronik recorder. Nine iron-constantan thermocouples, lead-jacketed, were inserted in various positions in the ager to record the adjacent steam temperature. The steam flow was metered by an orifice meter. The pressure in the ager was controlled by the automatic differential pressure controller located in the stack.

The following runs were made using a continuous strip of 80 x 80 cotton cloth 18" wide and 1000 yards long printed, but not aged. This material was a dried, all-over print of these standard print pastes: Indanthrene Golden Yellow GK, Indanthrene Brilliant Pink RAM, Indanthrene Blue BD and Indanthrene Brown RRA, formulated as 10% dye paste, 90% standard Potash-Rongalite (PR) thickener. The material was stored in atmospheres of less than 35% relative humidity prior to aging.

The amount of water to be added as liquid spray was calculated as follows:

Consider water absorption in normal aging=optimum spray rate.
Average water pick up in 5-minute aging=2.0 g/sq. ft. (experimental)
Rate of feed of 18" wide print to yield 5-minute aging=11.3 ft./min.
Water pick up of print=11.3 x 1.5 x 2.0=34 cc water/min.

These conditions prevailed throughout:
Ager pressure +.01" H_2O
Atmospheric conditions compensated by ager pressure control.
Air content uniformly 0.1% or less.
Steam quality 0%.

Run A
Steady steam flow 125 lbs./hr.
Variable feed rate 11.3 ft./min.
28.2 ft./min.
Spray rate 0 and 35 cc/min. (calculated value)

Run B
Variable steam flow 85-125 lbs./hr.
Steady feed rate 11.3 ft./min.
Spray rate 0, 35 and 60 cc/min. (calculated and 1½x calculated value)

Run C
Variable steam flow 85-125 lbs./hr.
Steady feed rate 11.3 ft./min.
Spray — 0 and 35 cc/min. (calculated value)

TABLE IV
Instrumentation of the Vat Ager to Obtain Constant Operating Conditions

Critcal Factor	*Optimum Operating Value*	*Method of Operation or Instrumentation*
Moisture Content of Print	0%	Dry to bone-dry state immediately after printing.
Relative Humidity	35% max.	Store prints in a dry atmosphere in the interval between printing and aging.
Steam Quality	0-5%	Steam quality greater than 5% should be avoided by use of mechanical strainers or separators.
Air Content of Steam	0-0.3%	Maintenance of a positive pressure within ager by proper sizing of gates and vents in conjunction with automatic ager pressures control located in vent stack. Maintain adequate steam flow.
Steam Flow	Sufficient to keep automatic ager pressure control operative	Automatic flow control valve operating in conjunction with ager pressure controller.
Atmospheric Effects	No variation.	Fully compensated by automatic ager pressure control.
Steam Temperature	212-217°F.	Automatic water spray on print surface at a point at least 15 seconds after introduction into ager. Water flow regulated by a print temperature recorder controller, sensitive element focussed on print at an appropriate distance past the point of spray application.

The observations which follow were made from these experimental runs. The steam temperatures in the ager increased an average of 4-9°F. above normal (212-217°F.) with passage of the print through the ager. A reduction in the ultimate print strength of about 10% accompanied this rise. Through the variation in steam flow employed (85 to 125 lb./hr.) no effect of steam velocity on this temperature rise or on ultimate print strength could be definitely noted. The print temperature showed an immediate tendency to increase on entering the ager, equilibrium being reached in about 15 to 20 minutes when the ager steam temperatures had also increased to an upper equilibrium value. Experimental indications of equilibrium print temperature were in the neighborhood of 234°F. Decreasing the aging time (increasing the speed of the print through the ager) tended to increase the print temperature further to 238°F. while simultaneously lowering the ager steam temperature 2-5°F., but at a sacrifice of 20-30% in ultimate print strength. The addition of water spray immediately reduced the print temperature 9-11°F. to values of 223-225°F. and returned the steam temperature in the ager to normal (215-217°F.). The ultimate print strength of sprayed prints was equal to, if not better than, a normally aged print. The calculated amount of water spray, 35 cc/min. proved satisfactory; any increase above this amount had no additional temperature lowering effect and moreover proved to be more water than the print could absorb, causing feathering of the resultant aged print.

The spray control system thus experimentally compensates for the effect of increasing steam temperature on the strength of the prints, without having recourse to increasing the steam flow. In commercial operation it is quite conceivable that this principle would prove quite useful both from the standpoint of eliminating the superheating effect as well as from savings in steam. It has been determined that atmospheric effects and air contamination can be eliminated by use of the automatic ager pressure control provided sufficient steam flow is maintained to keep the pressure control operative. The work on the

(Concluded on Page 685)

THE PRINTING OF NYLON PIECE GOODS*

DR. A. K. SAVILLE

NYLON has the unique distinction of possessing affinity for all classes of dyes when applied under the proper conditions. While this exceptional affinity opens a broad field of candidate dyestuffs to the printer interested in processing nylon, it dictates that extra emphasis be placed on dyestuff selection. Colors best adapted to the printing of the fabric and to its end use should be chosen. With these two qualifications in mind, extensive laboratory evaluations have eliminated some dyestuff classes as being unsuitable for nylon printing. The Naphthanil salts, Diagen types and related colors should not be employed since satisfactory development and shades are not obtained. Nylon prints, when compared with similar types on cotton, are usually considerably yellower and duller in shade, of poor crocking fastness and fugitive to light. Basic colors show exceptional affinity, but poor light and washing fastness prevent their serious consideration as colors for nylon. Leuco esters of vat colors such as Ponsol Blue BF Soluble exhibit poor affinity; full development cannot be accomplished by ordinary methods; and the resultant light fastness of the prints is poor. It is readily apparent from these considerations that the dyestuffs which will be used in nylon printing in the immediate future will be chosen from the acetate, vat, acid or direct classes.

A. Acid and Direct Dyes

Acid and direct colors include dyes with the best brightness and general fastness properties which can be applied to nylon. As a class these colors have good affinity for nylon although the affinity differs considerably between the various dyes. In practice it is not feasible to print nylon with acid or direct dyes in the absence of assistants, since the receptivity of the fiber can be considerably increased by the judicious choice of the proper assistant or assistant combination. Assistants for nylon printing can be considered as falling into two classes; one group includes acids or acid-forming compounds, which precipitate and fix the dye on the fiber during the steaming operation. The other type acts mainly as a solvent for the dye and as a swelling agent for the fiber thereby creating conditions for the easy and rapid penetration of the fiber by the dye.

Representative assistants of the former class are hydroxyacetic acid, lactic acid, or acetic acid. They are often satisfactory but, since acid and direct colors exhibit a lower solubility in the presence of acids, there is a tendency for many colors to speck in these pastes. To increase the solubility somewhat and to aid in color fixation, urea may be used in conjunction with organic acids in printing some colors. Unfortunately both the choice of acid and the use of urea are specific for the individual dyes. Care must be taken in making compound shades or unpredicted effects may result. With further selection, a fairly full shade range of dyes can be chosen, which work well in combination and possess excellent affinity for the nylon fiber. The color value produced by a 10-15 minute steaming is only slightly inferior to that obtained by cottage steaming.

It is seldom practical to restrict one's color selection to a short list of dyes since the difficulties in shade matching and in meeting fastness requirements are greatly increased. Furthermore, the lower color value obtained by short steaming, as compared to cottage steaming, does not always compensate for the shorter steaming time. These factors may be of considerable influence in prompting the cottage steaming of nylon prints. With cottage steaming, a much larger number of dyes can be satisfactorily printed using an organic acid and/or urea to fix the color. These assistants are specific for the individual dyes, however, and for optimum result, colors requiring different assistants should not be mixed. Random mixtures of dyes rarely produce the predicted shade. Even colors requiring the same assistant do not always produce the expected result and before prints are made with the organic acid-urea combination full laboratory testing for shade, strength, and fastness properties should be made.

Recent investigations on the printing of nylon with acid and direct colors were undertaken in an endeavor to reduce the restrictions on the selection of suitable colors. They have led to the development of a universal assistant combination which eliminates the need of specific assistant combinations and minimizes the printing difficulties encountered with mixtures of incompatible colors. This single assistant combination, a mixture of Kromfax, thiourea and ammonium sulfate, combines the three necessary requirements for a nylon printing assistant: a solvent action for the dye, swelling action in the fiber and an acid-forming salt to aid in fixation of the dye on the fiber. The affinity of acid or direct colors is somewhat increased by the use of this combination and if it is possible to use 10% Kromfax, 6% thiourea and 4% ammonium sulfate in the printing paste, excellent color fixation is obtained with the majority of acid or direct dyes during a ten-minute rapid aging. In some instances particularly when sheer goods are printed, it may not be possible to use this high concentration or flushing may occur. For such purposes, the amount of assistants may be reduced and some color value sacrificed, or the printed fabrics may be cottage steamed for one hour. Whether a high solvent concentration and a short steaming, or a low solvent concentration and a longer steaming are found more suitable, the advantages of this combination over the organic acid-urea assistant are readily apparent. Many of the earlier restrictions on color selection do not have to be observed, and the saturation point of the dye in the fiber is the limiting factor. Dyes can be chosen for their fastness properties and shades according to the purpose for which they are intended. It should be emphasized that not all dyes are suitable for use in this process but from the large number of available acid and direct color types, color selection can be made to suit any reasonable fastness or shade requirement. Working properties are considerably improved over those of earlier recommended methods because of the greater solubility of colors in the printing paste.

The fastness properties of selected acid and direct dyes on nylon are satisfactory for the majority of uses. While the washing fastness is not so good as that of the vat colors printed on nylon, it is suitable for goods which are to be hand washed at a low temperature. These dyes will stand

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repeated washings at 120°F., with little or no shade change or loss in strength. The critical requirement is the fastness to light. Chromacyl colors as a group exhibit the highest degree of light fastness particularly in the yellows, oranges, and blues, being superior to many other available dyes in these shades. Second only to the special acid colors in light fastness and superior in brilliance are the acid anthraquinone colors. Dyestuffs of this group supply greens and bright blues complementary to the yellows and oranges of the Chromacyl class. Where light and wash fastness are secondary to brilliance, large numbers of the azo-type dyes from the acid or direct classes may be profitably used for nylon printing.

B. Vat Dyes

Vat colors can be printed without exceptional difficulty on nylon, when a printing thickener similar to that used on cotton is employed. However, since the moisture adsorption of the fiber is low, care should be taken to use the minimum of hygroscopic components in the printing paste if flushing in the vat ager is to be avoided. For this reason, glycerine or other humectants should not be added to the printing paste nor should the assistant-type vat colors be employed if an aqueous-paste type is available. The alkali requirements of vat colors printed on nylon are low when compared with prints on cotton, and a maximum of 1 lb./gal. of potash or alkali is adequate. Alkali concentrations over this amount do not aid in color fixation but do contribute to the tendency of the print to flush during aging. Ten minutes rapid aging is required to fix the color although the actual affinity of the leuco for nylon is exceptionally good.

The affinity of the vat leuco for nylon and the tenacity with which it is held by the fiber is aptly illustrated by the difficulty of oxidizing many leucos to the pigment state after aging. Oxidation of the anthraquinone types proceeds fairly rapidly in an oxidation bath containing sodium perborate and acetic acid at 120°F., but with many of the Sulfanthrene (thioindigoid) types exceptional difficulty is encountered. Oxidation is rarely completed in the 2-3 minutes required by the Ponsol colors and with some particular dyestuffs can only be accomplished by aftertreatment in a hot acid bath.

Initial comparisons between the fastness properties of vat colors on nylon and of vat colors on cotton might lead to the impression that their use is limited to the latter fiber. A further consideration of the end use of the printed article will show that for a number of purposes the characteristics and fastness properties of the vat colors on nylon are unsurpassed.

The main deficiency of vat-printed nylon is its poor light fastness. While considerable variations occur between the various dyestuffs and shades, in no case is the fastness equivalent to that expected from experience on cotton. Thioindigoid types, in particular, exhibit poor light fastness, some withstanding as little as three Fade-Ometer hours. Vat dyes of the anthraquinone class are considerably better in this respect. A range of colors, with the exception of a red, show only minor breaks in 20-40 hours when printed on medium shades, and some are light-fast at 60-80 hours. Although the light fastness is inferior, the washing fastness is excellent. This exceptional wash resistance is demonstrated by the fact that little change in shade or strength occurs after five repeated thirty-minute washings at 180°F.; and many show no change in shade or strength after boiling for one hour in the presence of soap and soda ash. Because of this characteristic, vat colors will undoubtedly find application in the printing of laundry bags, undergarments and in other uses where light fastness is secondary to wash fastness.

C. Acetate Dyes

Dispersed acetate rayon dyes, used extensively for dyeing nylon, show good affinity for the nylon fiber when printed without assistants. The addition of small quantities of Cellosolve, urea, diethylene glycol or glycerine serves primarily to help disperse and partially solubilize the color and results in improved levelness and smoothness of the prints. Due to their excellent affinity and penetrating properties, these dyes show advantages in uniformity and control of shade over other classes of colors. Complete fixation of these acetate colors when printed with small quantities of solvent can only be affected by cottage steaming the printed fabric for one hour at atmospheric or slightly elevated pressures. As might be anticipated, increasing the quantity of solvent or swelling agent in the printing paste will accelerate the rate of fixation of acetate colors on nylon to a point where they are fixed in a ten-minute rapid aging. A mixture of 10% diethylene glycol and 5% glycerine has been found most effective. Care must be taken in using such a high solvent concentration, particularly when aging in a very moist steam atmosphere, or the colors will flush.

The acetate colors printed on nylon are not distinguished by good fastness properties, either to wet processing or to light. In prints, only Acetamine Yellow CG and Acetamine Orange GR are of satisfactory light fastness. These colors will probably not be used on nylon in cases where even a minimum of fastness is required and will be employed only where ease of processing is the main consideration.

Discharge Printing

With the rapidly developing interest in the application and printing of nylon piece goods, increasing emphasis is expected to be placed on white and colored discharge work on nylon. From extensive evaluation of acid, direct and acetate dyes, it has been shown, on a laboratory scale at least, that selected members of these dyestuff classes can be used as ground shades for white discharges. Because of the variations in dischargeability between the individual members of the different dye classes, it is not possible to choose a range of shades from any one group. However, by selecting colors from each of the three classes, a complete range of dyes can be recommended for white discharge work. The possible exceptions are navy blues, browns and blacks dyed in heavy shades.

From experience in the discharge printing of rayons dyed with direct or developed dyes, it would be expected that Sulfoxite C would be employed as a discharge agent. Most satisfatcory results are obtained on nylon when the white discharge paste contains Sulfoxite S and 10% diethylene glycol at a pH of 3.0 to 4.0.

When colored discharges are required, the best results are produced with a textile gum or British gum thickener containing no more than 1 lb./gal. of potash and 1 lb./gal. of Sulfoxite C. Optimum discharge of the ground shade and fixation of the vat color illumination are obtained by a 10-minute steaming.

Summary

From the numerous dyestuffs which show affinity for nylon, only the acetate, vat, acid or direct colors have a place in the printing of nylon. Choice of dyes from these classes will depend largely on the end use of the fabric but also on the fabric construction and available processing equipment. Acetate colors are characterized by poor fastness properties; vat colors by excellent wash fastness; and dyes from the acid and direct color class by their general good fastness which represents the best obtainable on nylon at the present. Techniques have been developed which allow colors of these classes to be fixed by a ten-minute rapid aging, but under some conditions with certain fabric constructions, more satisfactory results may be obtained when the fabrics printed with acid and direct colors are cottage steamed. While no commercial work has been done to date on white or colored discharges on nylon, proper color selection and discharge paste formulation should enable satisfactory prints to be produced. Additional experimental work and further practical application experience with the various fabrics and constructions will be necessary to achieve the maximum in fastness and printing quality.

ABSTRACTS OF PAPERS

to be Presented at Meetings of the Division of Cellulose Chemistry of the American Chemical Society Atlantic City, N. J., September 20 to 22, 1949

September 20
TEXTILES

Joint with Divisions of Colloid Chemistry and Physical and Inorganic Chemistry

INTRODUCTORY REMARKS. H. F. Mark.

POLYMOLECULARITY OF VISCOSE RAYON AND RAYON-GRADE PULPS. A FRACTIONATION STUDY. W. E. Davis, Hercules Powder Company, Wilmington, Del.

THE theory of fractionation as developed for polymolecular materials is briefly reviewed, and its consequences for the results to be expected from fractionation by precipitation under various conditions are pointed out.

Fractionation data for six samples of viscose tire-cord rayon are presented. These were obtained by fractional precipitation of the nitrated rayons from acetone solution by means of hexane, and in most cases represent the results of three stages of fractionation. Numerous differences were found, but the one which could be estimated most reliably was a large variation in amount of low-molecular-weight (degree of polymerization, less than 180) material present. The nitrates from the pulps corresponding to these rayons were therefore fractionated by a shorter procedure aimed at determining only the content of low-molecular-weight material. This was found to correlate well with the same figure for the rayons. A fair correlation was also found between low-molecular-weight material in the rayons and the results of fatigue test on the yarns.

In the course of the study some work was also done on the viscosity-molecular weight relationship for cellulose nitrate. The results of this work are presented and compared with those in the recent literature.

SEDIMENTATION AND DIFFUSION IN CELLULOSE SOLUTIONS. F. C. Brenner and F. Eirich, Polytechnic Institute of Brooklyn, Brooklyn, N. Y.

THE authors review and critically evaluate recently reported work on diffusion and sedimentation of cellulose in solution. Two studies carried out at the Polytechnic Institute are reported.

The first refers to the molecular weight and molecular weight distribution of cellulose recovered from solution in concentrated sulfuric acid. There is some evidence that sharp fractions are obtained.

The second study concerns the measurement of sedimentation and diffusion constants of carefully prepared solutions of chemical cotton in cupriethylenediamine solutions. The samples have have been characterized by their viscosity and the value for the viscosity constant in cupriethylenediamine has been reassessed.

CRYSTALLINITY OF CELLULOSE AND ITS SIGNIFICANCE FOR FIBER PROPERTIES. Kyle Ward, Jr., Southern Regional Research Laboratory, New Orleans, La.

BASED on the physical and chemical properties of the material, the arrangement of the cellulose molecules in the fine structure of cellulosic fibers may vary gradually from completely random distribution to orderly crystalline aggregates. A brief review of the history of this concept with discussion of some other viewpoints is given in this paper. Cellulose fibers may vary considerably in their degree of lateral order or "crystallinity." Considerable evidence is available as to the effect of this factor on the physical and chemical properties of various cellulosic fibers. These data are given as well as recent data obtained at the Southern Regional Research Laboratory with particular reference to cotton.

CREEP AND RECOVERY OF TEXTILE MATERIALS. Turner Alfrey and M. T. O'Shaughnessy.

EXISTING experimental results on the creep and elasticity of textile fibers, including some results hitherto unpublished, are reviewed briefly. The underlying problem in providing an explanation for these phenomena is then formulated, and some previous theories of the tensile properties of textiles are considered briefly in terms of this formulation.

The paper presents the viewpoint that tensile phenomena in textiles are best understood in terms of the simultaneous operation of two types of mechanisms, the one delayed reversible elasticity, relatively linear with stress, and the other irreversible in character and often extremely nonlinear with stress. The first of these processes may be identified as, chiefly, the configurational elasticity of the amorphous material, limited and modified in the present case by pre-existing orientation, by the limited length of the chain segments involved and the relatively strong interchain forces between them, and by the geometry of their cross linking by the crystallites. Reversible crystallization in extension would also fall in this first category. The second process may be tentatively identified as including irreversible changes in crystallite orientation, irreversible changes in degree of crystallinity, and such phenomena as crustal slip. Nylon drawing provides an extreme example. The investigation of tensile properties is complicated by the fact that processes of the second type may take place simultaneously with those of the first type, and in doing so produce changes in the properties of the material with respect to the first, reversible type of deformation.

FACTORS CONTRIBUTING TO THE FELTING PROPERTIES OF WOOL. Milton Harris, Harris Research Laboratories, Washington 11, D. C.

THE ability of wool and other animal hair fibers to felt may be considered to be the most unique property possessed by any fiber or class of fibers. From an industrial point of view, this property contributes in a major way to the use of wool and materials such as hats, sweaters, flannels, industrial felts, etc. On the other hand it is the greatest deterent to the wider use of wool in socks, sweaters, shirts, or any materials which are frequently subjected to laundering conditions.

Although a major part of present thinking on the problem of felting is concerned with the tendency of wool garments to shrink excessively under laundering conditions, a better understanding of the felting process is of equal importance to a large segment of industry which harnesses these properties to produce felts or as a finish for fabrics.

It is now known that the felting phenomena is a complex function of the chemical, mechanical, and morphological properties of the fiber. It appears that these properties contribute to felting in the following manner:

They result in a tendency of the fibers to bend or curl and thus become entangled under the influence of moisture, heat, and mechanical work.

They confer on a fiber a tendency to migrate in an unidirectional manner under these same conditions.

They are responsible for the ability of hair fibers to be stretched considerably but to recover completely from extension.

FACTORS INFLUENCING THE MEASUREMENT OF THE DYNAMIC PROPERTIES OF TEXTILES. W. James Lyons, Chemical & Physical Research Laboratories, Firestone Tire & Rubber Company, Akron 17, Ohio.

A BRIEF description, by way of review, of the textile stretch-vibrometer developed in the Firestone Research Laboratories, along with an outline of the theoretical basis of the method, is given. Typical measurements of the dynamic properties of a number of cords, yarns, and monofils are presented. Evidence is submitted to show that the dynamic modulus is definitely a function of static tensional load, that the internal-friction coefficient is functionally related to frequency of vibration, and that the modulus, as well as the hysteretic energy-losses, is a function of the strain-amplitude. Consideration is given to other borderline cases of the influence of test conditions which suggest the need for uniformity in these conditions.

CREASING AND CREASEPROOFING OF TEXTILES. D. D. Gagliardi and I. J. Gruntfest, Rohm and Haas Co., Philadelphia, Pa.

CELLULOSE fabrics may be made resistant to creasing or wrinkling by treatment with a variety of compounds whose action appears to produce either chemical or physical cross linking of the molecular chains composing the fibers. Examination of the stress-strain properties of treated viscose rayon fibers shows that all creaseproofing compounds increase the elastic modulus, reduce creep, and improve the elastic recovery. In order to be effective, such celluose modifying agents must be diffusible in the cellulose. Nondiffusible materials, which are simply deposited on the fiber surfaces, do not improve crease resistance, but may cement the fibers together, reduce the multifilament character of the fabric, and produce stiffness.

Viscose rayon fabrics can be made resistant to creasing or wrinkling much more easily than cotton materials. While the chemical reactions involved in the modification of viscose and cotton cellulose are identical, the physical and morphological properties of the two fibers are very different, so that their response to cross-linking reactions is also different. Any compound which can creaseproof rayon will also be effective on cotton fabrics, except that, in the latter case, the high concentration of material required to produce good resistance to creasing usually reduces the over-all toughness of the fabrics, resulting in low tensile, tear, and abrasion resistance properties. The solution to the problem of making crease or wrinkle-resistant cotton fabrics lies not so much in the synthesis of unusual types of chemical compounds, as in the engineering of new fabric constructions ideally designed for maximum wrinkle resistance. With such specially designed fabrics, a large number of compounds will easily increase further the fabrics resistance to creasing or wrinkling.

September 21

DEGRADATION OF CELLULOSE

Joint with National Research Council

Milton Harris, *Presiding*

INTRODUCTORY REMARKS. Milton Harris.

DEGRADATION OF CELLULOSE AS REVEALED MICROSCOPICALLY. Charles W. Hock, Hercules Experiment Station, Hercules Powder Company, Wilmington, Del.

BECAUSE natural cellulose is fundamentally fibrous, degradation—be it caused by chemical agents such as acids and alkalies, by physical agents such as grinding and ultrasonic vibrations, or by biological agents such as molds and bacteria—proceeds in a manner which reflects this basic fibrillate structure. The dimensions of the threadlike fibrils into which cellulose breaks down vary depending on the severity of the treatment and perhaps also on innate differences among celluloses from various sources. Following degradative action, light microscopy reveals fibrils on the order of several tenths of a micron in diameter. At the higher magnifications obtainable with the electron microscope still finer fibrils a few hundred Angströms wide are detectable. Certain degradative treatments cause a further transverse splitting of these fibrils into rod-shaped structures.

From x-ray and chemical investigations it is known that cellulose is made up of long-chain molecules whose arrangement with respect to one another gives rise to more or less ordered but poorly reactive crystalline regions and to disordered but easily reacted amorphous regions. Since microscopical studies show that many reactions proceed more easily between the fibrils than within the fibrils themselves, it appears that the crystalline cellulose is located principally in the fibrils, while the interfibrillar regions account in large measure for the amorphous fraction.

HYDROLYTIC DEGRADATION OF CELLULOSE. O. A. Battista, F. F. Morehead, and W. A. Sisson, American Viscose Corporation, Marcus Hook, Pa.

THE chemistry of the hydrolytic degradation of cellulose is reviewed briefly. The detailed discussion considers, primarily, the physical chemical effects of the acid degradation reaction on celluose during the early stages while the product is still substantially fibrous.

Changes in tensile properties, degree of polymerization, reducing power, solubility, reactivity (accessibility and crsytallization) with progressive hydrolysis are given. The above changes are shown to depend upon the time, temperature, and pH of the hydrolytic reaction, as well as upon the heterogeneity of the fine structure of the starting material.

The dependence of the so-called "limiting D.P." on the above noted reaction variables and the starting material is illustrated, and various theories to account for such phenomena are discussed.

X-ray, electron microscope, and degree of polymerization data showing the combined effects of hydrolytic (chemical) and mechanical (supersonic) degradation are presented, and interpreted in terms of the crystalline and amorphous fine structure

of celluose and the mechanism of the hydrolytic degradation of cellulose.

Finally, possible methods of controlling the acid degradation of cellulose are considered.

OXIDATIVE DEGRADATION OF CELLULOSE. C. B. Purves, McGill University.

A BRIEF review of published work by various authors, and of some unpublished work by the author, on oxidations of celluose and starch. Emphasis is placed on the influence exerted by the accessibility of the cellulose on the course of the oxidations.

HEAT DEGRADATION OF CELLULOSE. W. E. Roseveare.

THE degree of degradation, the chemical reactions, and the physical changes occurring during the heating of cellulose depend on the amount of air and moisture present. The degradation is slowest in the absence of air and moisture. Either air or moisture accelerates the degradation, but the simultaneous presence of both air and moisture increases degradation much above the sum of the effects of air and moisture alone. Heating cellulose in a vacuum produces carbon dioxide, carbon monoxide, and water vapor, while heating in air produces aldehyde and carboxyl groups and increased amounts of carbon dioxide. Water vapor accelerates the consumption of oxygen and the evolution of carbon dioxide.

Physical changes result from the cutting of the chains. Decreases in moisture regain and changes in x-ray patterns indicate an increase in crystallinity results from cutting of the chains. The loss in strength for a given drop of degree of polymerization as measured by cupriethylene diamine viscosity is less on heating in a vacuum than in the presence of air and moisture. Rayon cords lose strength faster than cotton in the presence of air and moisture, but in a vacuum cotton cord loses strength faster than rayon.

MICROBIOLOGICAL DEGRADATION OF CELLULOSE. Glenn A. Greathouse.

CELLULOSE-DECOMPOSING activity of microorganisms is very widely distributed, but not universal among fungi and bacteria. This knowledge has been obtained through the efforts of many investigators in many laboratories. A brief review of the microorganisms and the investigators involved in these studies is presented.

The manner in which microorganisms attack and penetrate cotton fibers and bring about a reduction in tensile strength is discussed. Data are presented to show the relationship between molecular structure and microbiological resistance. Preparation of cellulose derivatives substituted at known positions in the molecule by selected substituents have been evaluated for resistance to attack by *Myrothecium verrucaria,* U.S.D.A. 1334.2, originally isolated and reported by Greathouse et al, as a very active cellulose-decomposing organism.

Data showing hydrolysis of cellulose and loss in tensile strength of cotton fibers by a cellulolytic preparation from *M. verrucaria,* 1940 to 1943, are presented. These data are compared with the recent work of Saunders and Siu using *M. verrucaria* as the source of a cellulolytic preparation and that of Walseth using commercially available enzyme preparations.

METHODS OF PREVENTION OF MICROBIOLOGICAL DEGRADATION OF CELLULOSE. Ralph G. H. Siu, Philadelphia Quartermaster Depot.

THERE are three general approaches to the prevention of microbiological breakdown of cellulose and cotton textiles.

The first is based on a killing or arresting the growth of the invading bacterium or fungus through the use of toxic agents. About a thousand compounds have been tested so far. Of these, copper salts still remain the most satisfactory from an overall standpoint of availability, cheapness, stability against sunlight, resistance to leaching, protection against microorganisms, and compatibility with other fabric finishes. The search for new compounds continues to be empirical, although many studies have been made on the relationship between molecular structure and toxicity. The results of the latter type of fundamental studies so far have been primarily valuable in classifying and correlating known compounds, rather than predicting new fungicides.

The second method involves the use of resin coating or impregnation of cloth. This is based on the observation that the action of microorganisms is highly localized. It was found that a thin inert barrier separating the fungus or bacterium from the fiber surface will suffice to retard microbiological action. In the use of such coatings, however, care should be exercised in the proper choice of plasticizers. Fatty acids, castor oil, and similar types support mildew, while phosphates and phthalates are less susceptible.

The use of acetylation has been expanded recently into a general approach of topochemical modification of cotton fibers for the simultaneous acquisition of mildew resistance as well as other properties by one and the same treatment. It appears that as long as one hydroxyl group in every anhydroglucose unit is blocked by a new substituent, the resulting derivative will be resistant to mildew. Within broad limits, the nature of the substituent per se does not determine the resistance to mildew. Consequently it is possible to select those substituents which will impart properties to the cloth other than mildew resistance alone. Several multipurpose topochemical modifications have been prepared in the laboratory but much more work will be required before these findings can be extended to the production stage.

September 22

GENERAL

R. F. Conaway, *Presiding*

INTRODUCTORY REMARKS, R. F. Conaway.

PYRIDINIUM SALTS OF CELLULOSE ACETATE-CHLOROACETATE. C. J. Malm, J. W. Mench, R. F. Williams, Jr., and G. D. Hiatt, Eastman Kodak Company, Rochester, N. Y.

THE preparation of cellulose acetate-chloroacetates by a variety of procedures was described: esterification of secondary cellulose acetate with chloroacetic anhydride; esterification of secondary cellulose acetate with chloroacetic acid; introduction of chloroacetyl during hydrolysis of cellulose acetate with aqueous chloroacetic acid; and hydrolysis of cellulose acetate-chloroacetate in aqueous chloroacetic or acetic acids.

Properties and method of analysis of these mixed esters were given.

The reaction of these products with tertiary amines such as pyridine was shown to go substantially to completion, yielding quaternary ammonium salts. Many of these were water-soluble, but hydrolized readily in aqueous solution to regenerate cellulose acetate and liberate the pyridinium salt of chloroacetic acid, *N*-carboxymethylpyridinium chloride.

Examination of the hydrolysis rates of simple, aliphatic alcohol esters of *N*-carboxymethylpyridinium chloride indicated the reaction to be autocatalytic. Comparison of the rates showed the celluolse esters to hydrolyze more rapidly than the esters of ethyl and butyl alcohols.

The pyridinium salt of a cellulose acetate-β-chloropropionate was also described. This was more stable to hydrolysis than the alpha-betaine compounds prepared from either cellulose or ethyl and butyl chloroacetates.

CELLULOSE ESTER VISCOSITIES BY THE BALL-DROP METHOD. Carl J. Malm, Leo B. Genung, and George B. Lapham, Eastman Kodak Company, Rochester, N. Y.

THE ball-drop method is useful for measuring viscosities of concentrated solutions of cellulose esters. Several ball-drop viscometers are described. They are readily constructed from simple apparatus, are useful over a considerable range of viscosity, and are easily calibrated.

Viscosity results expressed in seconds are acceptable for control purposes, but they should be converted to absolute or kinematic units for engineering purposes and for a more thorough understanding of the properties of the solutions. Procedures for the measurement of viscosities and determination of the necessary conversion factors are presented. The Faxen equation is particularly useful for the latter purpose.

If viscosity data are to have practical significance, it is necessary to use solvents, concentration, and temperature closely duplicating use conditions. Pronounced viscosity effects may be caused by variations in concentration, temperature, solubility, density of the solvent, purity of the solvent, and the presence of certain ions. It is, therefore, not possible to predict viscosities of concentrated solutions accurately from data obtained on dilute solutions.

SALT EFFECT IN CELLULOSE ACETATE. C. J. Malm, Leo J. Tanghe, and Glenn D. Smith, Eastman Kodak Co., Rochester, N. Y.

CERTAIN salts increase the viscosity of cellulose acetate in concentrated solution. The term "salt effect" is used herein to designate the ratio of the viscosity of one portion of cellulose acetate washed with water containing a certain salt to the viscosity of a second portion washed with salt-free water or with water containing a salt known to have no effect on the viscosity.

The following factors have been studied in relation to the effect: (1) nature of the salt, (2) amount of salt, (3) pH of the solution from which the salt is applied, (4) solvent for the cellulose acetate, (5) concentration of cellulose acetate in solution, (6) degree of hydrolysis of cellulose acetate, and (7) amounts of carboxyl and combined sulfate in the cellulose acetate.

A procedure has been developed for measurement of the salt effect of cellulose acetate.

Small amounts of carboxyl were introduced in cellulose acetate by oxidation with potassium permanganate, and a good correlation was observed between carboxyl content and salt effect. The presence of more carboxyl groups in wood pulp than in cotton linters accounts for the greater salt effect in cellulose acetate made from wood pulp.

Carboxyl groups have been introduced on high and low viscosity fractions of cellulose acetate. Blends showed that the carboxyl groups on the high viscosity fraction exert a greater salt effect than those on the low viscosity fraction.

Combined sulfate groups have an effect similar to carboxyl.

PRIMARY HYDROXYL GROUPS IN HYDROLYZED CELLULOSE ACETATE. C. J. Malm, Leo J. Tanghe, and Barbara C. Laird, Eastman Kodak Company, Rochester, N. Y.

TRITYL ethers were prepared from numerous samples of cellulose acetate, and the amount of trityl introduced was taken as a measure of the amount of primary hydroxyl present. The tritylation conditions were carefully standardized with respect to time, temperature, and amount of reagents. However, the values obtained are regarded as comparative rather than absolute because of the possibility of reaction of some of the secondary hydroxyl groups.

The percentage of primary hydroxyl in a hydrolized cellulose acetate is influenced by the amount of water in the hydrolysis bath. An increase in water concentration gives an increase in percentage of primary hydroxyl.

The percentage of primary hydroxyl is not affected by the temperature of hydrolysis in the range 77° to 160° F., nor by the amount and nature of the catalyst during the hydrolysis.

The amount of sulfuric acid catalyst in the esterification influences the percentage of primary hydroxyl in the early part of the hydrolysis. Hydroxyl groups resulting from the hydrolysis of combined sulfate are largely primary.

The tritylation method is preferred over the tosylation and iodination method, since it is a single-step reaction and fewer variables are involved.

THE RATE OF ESTERIFICATION OF PRIMARY AND SECONDARY HYDROXYLS OF CELLULOSE WITH P-TOLUENESULFONYL (TOSYL) CHLORIDE. Emil Heuser and Merle Heath, The Institute of Paper Chemistry, Appleton, Wis.

CHEMICALLY reactive cellulose was prepared by regeneration from cellulose xanthate solution, replacing the water in the swollen structure successively with methanol, ethyl ether, and cyclohexane. Two series of heterogeneous esterifications with tosyl chloride in pyridine were made on two such cellulose samples, with reaction times ranging from 30 minutes to 50 hours. The products were treated with sodium iodide in acetonylacetone to replace the tosyl groups in primary alcoholic positions by iodine. From the analytical data, the reaction for both primary and secondary hydroxyl groups of cellulose was proportional to the concentration of free hydroxyl groups—that is, the equations for first-order reactions were followed (in the presence of an excess of tosyl chloride), with the rate constant for substitution on the primary position being nearly six times the rate constant for the combined secondary positions.

REACTION OF FORMALDEHYDE WITH COTTON. Charles F. Goldthwait, Southern Regional Research Laboratory, New Orleans, La.

PARTIALLY methylenated cottons have been prepared by reaction with formaldehyde under acid conditions in nonaqueous (mainly acetone) solutions. Although not differing from ordinary cotton in appearance and general textile character, the modified cotton acquires new properties even at relatively low formaldehyde contents—from 0.5 to 2 per cent—which may prove to be of practical importance.

The progress and uniformity of the reaction can be followed not only by analysis for combined formaldehyde, but also very conveniently by a reduction in the capacity of the cotton for taking up a direct dye, this work affording an excellent example of the possibilities of such dyeing techniques.

When the formaldehyde treatment is performed suitably, dye-resisting yarns of possible technological interest are produced. The dye-resisting effect has been explained as due to cross bonding which reduces the swelling of the cotton, the treated cotton having a decreased swelling capacity in water as well as in other agents which swell or dissolve cotton.

Products of the higher formaldehyde contents have good resistance to biological rotting.

Maintenance of normal breaking strength of the cotton is difficult but the strength can be fully retained under some conditions.

Effects of water present in the cotton and in the reaction mixtures indicate that the state of swelling of the cotton as controlled by its moisture content is especially significant in determining the properties of the reaction products.

EXISTENCE OF CARBOXYLIC GROUPS IN CELLULOSIC MATERIAL. Olli Ant-Wuorinen, The State Institute for Technical Research, Helsinki, Finland

THE presence of titratable acidity in deashed and thoroughly water-washed

(Continued on Page 685)

Proceedings of the
American Association of Textile Chemists and Colorists

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September 19, 1949

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Morris Sayre

Morris Sayre to Speak at Convention Banquet

MORRIS SAYRE, chairman of the board of the National Association of Manufacturers, will address the 28th National Convention to be held October 13-14-15 at the Chalfonte-Haddon Hall, Atlantic City, N. J. Mr. Sayre, also president of the Corn Products Refining Company, will speak at the Annual Banquet on Saturday evening, October 15.

A resident of Montclair, N. J., the NAM executive also is a director of the New England Grain Products Co., of Boston and of the Foundation for American Agriculture, of Chicago. He is a trustee of the New York Trust Company, the University of Richmond and of the Phi Gamma Delta Educational Foundation.

He began his business career in 1908, shortly after his graduation from Lehigh University as a student engineer, at the Granite City, Illinois, plant of the Corn Products Refining Company and has been associated with the firm ever since, rising to his present post after starting as an assistant master mechanic.

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Army and Navy to Exhibit at Convention

THE Army and Navy have joined the ranks of exhibitors at the 28th National Convention to be held October 13-14-15 at the Chalfonte-Haddon Hall, Atlantic City, N. J., and both service branches will endeavor to shed additional light on the science behind specifications.

In welcoming the military and naval exhibitors, the Convention Committee viewed their appearance as furnishing an excellent opportunity to enlighten the surprisingly large number of individuals to whom the operations of the Army and Navy supply organizations are still mysterious.

These exhibits also are expected to show the activities of the research and development divisions as well as the techniques of testing used in conjunction with textile procurement.

The Army and Navy exhibits will be housed in booths No. 19 through No. 27 on the Sunporch of Haddon-Hall and are expected to be of mutual benefit both to the services and industrial delegates to the convention.

—♦ ♦—

Intersectional Contest Committee, Northern New England Section

JOHN H. SKINKLE, Associate Professor in the Textile Chemistry and Dyeing Department, Lowell Textile Institute, is Chairman of the Intersectional Contest Committee for the Northern New England Section.

Mr. Skinkle received his B.S. in Chemical Engineering from the Massachusetts Institute of Technology in 1924 and his M.S. in Textile Chemistry from Lowell Textile Institute in 1940. He was instructor in chemistry at the New Bedford Textile School 1924-1926 and has been successively an Instructor, Assistant Professor and Associate Professor at Lowell since 1927. He is a member of the A.A.T.C.C. General Research Committee and of several subcommittees. He is the author of "Elementary Textile Microscopy" and "Textile Testing". He was a member of two previous Intersectional Contest Committees for the Northern New England Section. Most of Prof. Skinkle's present work is on instruction in graduate studies.

Other members of Prof. Skinkle's committee are:

Frank J. O'Neil
Pacific Mills
Leslie Christison
American Woolen Company
Sawyer F. Sylvester
Monsanto Chemical Co.
Ernest R. Kaswell
Fabric Research Laboratories
Joseph B. Masaschi
Lowell Textile Institute
Jacob K. Frederick, Jr.
Lowell Textile Institute

The title of the paper, which will be presented by Prof. Skinkle in the Intersectional Contest in Atlantic City, is "Practical Tests for Quantitatively Evaluating Dye Characteristics and Dye Methods". The judge representing the Section in the Contest is Herbert E. Wieland, American Woolen Co.

Fall Meeting of Mid-West Section to be Held September 24th

THE fall meeting of the Mid-West Section will be held at the Bismarck Hotel, Chicago, Illinois, on Saturday, the twenty-fourth of September in which the annual election of officers will be held.

At the afternoon session, starting at 2:30 P.M., Dr. Leonard J. Armstrong, Textile Development Chemist with Armour & Company will present a paper based on a general discussion of the products supplied by the packing industry and used in textile processing.

Dinner will be served promptly at 7:00 P.M., after which the speaker of the evening will be Robert H. Nuttall, head of the technical department in the Charlotte, N. C., office of American Aniline Products, Inc. He will speak on "Fast Coloring Obtainable with Naphthols and Vat Dyestuffs."

There will be an opportunity for general discussion at the conclusion of both papers.

—♦ ♦—

Report of Rhode Island Section Outing

THE annual outing of the Rhode Island Section was held on June 24th, at the Wannamoisett Country Club in Rumford, R. I., with 300 members present. Tom Larson, of Carbic Color & Chemical Co., did an excellent job as chairman.

The feature of the outing was the golf tournament, with many also joining in the putting contest. Good fellowship was enjoyed by all.

Mr. Larson, who retired the 1st R. I. Section Cup in 1938, won his first leg on the present trophy with a gross of 74. Ralph Hawes, of the Apponaug Co., placed 2nd with a gross of 77; and also won the prize for the longest drive. The "nearest to the pin" contest was won by Ted Connell, of Joan Plush Mills. R. J. Mitchell, of Sandoz Chemical Works, won the prize for the most fives. Walter Cook, of Cook Yarn Dye Mills, won the kickers prize with a net of 78.

After an excellent dinner many fine door prizes were distributed. Elliot Broadbent, of Glenlyon, and Andrew MacKenzie, of Stillwater, had their usual good luck in this drawing.

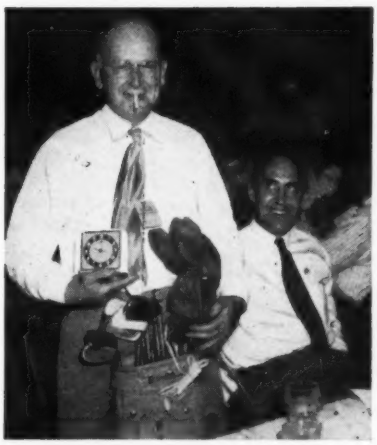
Photos of R. I. Section Outing →

Head Table—Herb Travis, A. Newton Graves, Tom Larson, Robert Joerger, John Harley.

Alfred Hampshire, John Benedict, Carl Green, Cliff Carlson, Phil Strengs

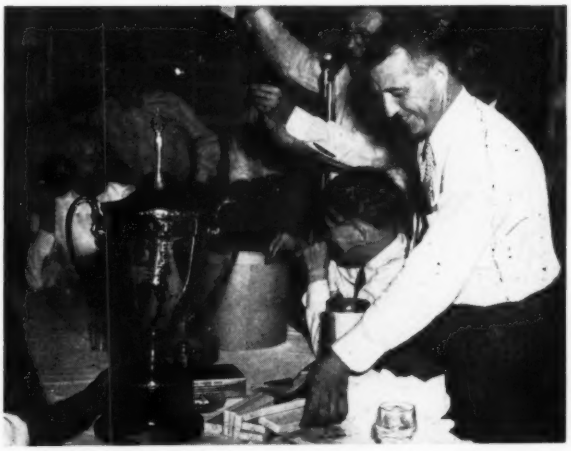
Dr. Grimmell, center; Carl Funke, right

Harold Sturtevant, George Wood, Harold Blomquist, Alden D. Nute



Elliot Broadbent and Ornulf Heiberg

Andrew MacKenzie



L. to R.—Arthur Hirst, A.A.T.C.C. Trophy for Low Gross, Herbert Travis, A. Newton Graves, Tom Larson

Jean Carroll

Jean Carroll on Entertainment Program for National Convention

JEAN CARROLL, The Guardsmen and other stars of the entertainment world will highlight the social activities of the 28th National Convention at Atlantic City, N. J.

The Convention Committee believes it has been especially fortunate in securing the services of Miss Carroll, rising young comedienne, who already has attracted national attention in appearances on radio, theatre and club stages.

A hit on the Sealtest Coast-to-Coast radio show, Miss Carroll also won the acclaim of audiences at the famed Copacabana in New York and the Capitol Theatre, also in Manhattan. She also has been starred at Ciro's, in Hollywood, Chez Paree in Chicago, El Rancho, in Las Vegas, Lookout House, in Covington, Kentucky, and many other spots throughout the country.

Those who like excellent choral work will appreciate the Guardsmen, also known to Los Angeles, New York, New Orleans, and Detroit, as well as the other stars who will perform for those attending the Convention social affairs.

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Analytical Methods for a Textile Laboratory

Through the generous efforts of a committee headed by Professor Theel of the Philadelphia Textile Institute, "Analytical Methods for a Textile Laboratory" have been completely rewritten, and are now published in an attractive bound volume of 287 pages, in form similar to the older Year Books. Contents are as follows—

"General Instructions; Standard Solutions; Reagents; Methods of Sampling; Methods of Analysis of Chemicals; Determination of Finishing Materials and Determination of Resins and Resin Finishes; Identification of Dyestuffs on the Fiber; Determination of Textile Fibers; Useful Tables and Calculations; Index."

This book can be obtained from the Secretary, A.A.T.C.C., Lowell Textile Institute, Lowell, Mass., postpaid, for six dollars. To members of the Association, for one copy only, the price is five dollars.

CALENDAR

PHILADELPHIA SECTION

Meeting: November 11 (Kugler's, Philadelphia).

PIEDMONT SECTION

Meeting: November 5 (Charlotte Hotel, Charlotte, N. C.

HUDSON-MOHAWK SECTION

Meeting: November 18.

NEW YORK SECTION

Meetings: September 23, November 18 (Swiss Chalet, Rochelle Park, N. J.)

NORTHERN NEW ENGLAND SECTION

Meetings: November 4 (Lowell Textile Institute), December 2 (Boston).

WESTERN NEW ENGLAND SECTION

Meetings: September 23 (Waverly Inn, Cheshire, Conn.), November 4 (Rapp's Restaurant, Shelton, Conn.), December 9 (Danbury, Conn.)

SOUTHEASTERN SECTION

Meetings: October 1, December 3 (A. French Textile School, Georgia Institute of Technology).

MID-WEST SECTION

Meeting: September 24 (Bismarck Hotel, Chicago).

COUNCIL

Meeting: December 9 (New Yorker, New York).

RESEARCH COMMITTEE

Meeting: Dec. 9.

NATIONAL CONVENTIONS

1949: October 13 to 15, Chalfonte-Haddon Hall, Atlantic City.
1950: September 28 to 30, Portsmouth, N. H.
1951: October 18 to 20, Statler, New York.
1952: Boston.

EMPLOYMENT REGISTER

This column is open for four insertions per year, per member, without charge. Blanks can be obtained from, and filed with, the Secretary of the Association, Lowell Textile Institute, Lowell, Mass. It is understood that these will be open to inspection by prospective employers, who can obtain further information from the Secretary.

49-22

Education: Graduate of Bradford Durfee Technical Institute, with honors.

Experience: Summer in textile mill laboratory.

Age 20; girl; unmarried; references; vicinity of Providence, R. I. preferred.

8-22, 9-5, 9-19, 10-3

49-23

Education: Textile High School, with college courses in chemistry.

Experience: Laboratory and plant technician.

Age 23; unmarried; references; vicinity of New York City preferred.

49-24

Education: PhD, Switzerland.

Experience: Roller and screen printing of all fibers; finishing, including resins and anticrease treatment; superintendent, research chemist and chief chemist, abroad and in U.S. since 1942.

Age 45; married; references.

Don't delay your reservations for the Atlantic City Convention
•
October 13-14-15
•

THE SCREEN PRINTING OF TEXTILES*

E. S. BETON

THIS paper will describe the evolution from simple beginnings of a new art, viz. screen printing, and its spectacular rise during the past twenty-five years or so to the status of an industry. The development from hand block technique to hand screen technique has been found convenient by many operators, for many of the working details, such as the fastening down on the table, some of the methods of fitting, the manner of drying, and the ancillary treatments of the fabric before an after printing, have often been founded on hand-block print-works practise. This has not always, however, proved to be an unmixed blessing.

We must not allow this evident association between the block and the screen to mislead us into supposing that the screen has no bearing on the art of roller printing, for such is far from the case. There is no doubt that the whole outlook for printed textiles has been modified very considerably by the rapid development of the screen as a means of decorating fabrics. A generation ago, as far as quantity was concerned, the roller printing machine was supreme, producing the great bulk of printed fabrics. There were excursions here and there into special methods, such as rotary surface printing, spray printing, and even the lithographic printing of textiles, but by and large the copper roller was dominant, and the hand block, the puny heir of an ancient and honorable craft, the remnant of the flourishing hand-block industry of the early nineteenth century, was severely restricted and confined in its operations to certain high-class and exclusive spheres, such as men's wear, i.e. printed ties, handkerchiefs, and reefers, specially fine furnishings, and to a small extent certain ladies' dress styles. It appeared that the hand block printer could look forward only to declining activity and to something very near to extinction. Some of the beautiful work still being carried out by the hand block suggests that we need not fear so acutely today that the block will eventually be ousted by the machine.

It is none the less possible that hand block printing will suffer considerably from the competitive power, technical and commercial, of screen printing, the third or intermediate arm of the pictorial adornment of textiles. This new craft began by being a purely hand affair, a simple application to textiles of the primitive method of stencilling, involving no mechanical devices and yet sparing the hand printer the physical exhaustion, and indeed the nervous and optical exhaustion, which are associated with the hand block. It has developed to the dimensions of an industry which has within it a challenge equally for the exclusive high-class products of the hand block printer and for the mass-production of the roller machine printer. The former must look to his laurels in the matter of brilliance of colors and in the realm of novelties, e.g. the popular ladies' head-squares. The latter, the roller printer, has already felt the competition from that elasticity of production which is the commercially attractive feature of screen printing.

The screen affords a convenient means of handling medium quantities, say up to two to three thousand yards to a coloring, in characteristic colorings, with uncrushed colors, at comparatively low cost of engraving, with low capital outlay, and with a comparatively low demand for highly skilled labor. This applies particularly to the printed-dress trade, where not only can the screen printer give much shorter runs than the roller man will undertake, but where also he can, if necessary, respond to demand with quite astonishing quantities. The coining of the rather misleading name "Machine Screen" to describe roller-printed goods, chiefly florals, produced in imitation of, or in competition with, screen-printed goods is an indication of the extent of the commercial pressure placed upon the machine printing industry by the screen printer.

The evolution of the stencil into the scren must be placed to the credit of the Japanese, who developed the art of stencilling to a high degree, as examples show. While the European textile printer made only small use of the stencil, for he was unable to overcome the obstacle of "ties" which hold in position the "island" parts of the stencil, the Japanese did this by several methods. Sometimes they used two stencils for ecah color, each stencil comprising parts of the pattern, and printed them joining together to give the complete color, which must have entailed great difficulties of fitting and consequently have called for high craftsmanship in the printing. In order to alleviate these difficulties, and to simplify this cumbrous procedure, they produced the stencil upon a permeable background or mesh, using two identical stencils of rice paper and holding them together with human hair or by means of a layer of raw silk threads, which did not impede the printing of the color on to the fabric and yet gave support to the stencil. This is the critical step which marks the birth of the screen, and lays open to exploration a new tool for the use of man. This discovery is touched with that originality of conception which is characteristic of those epochmaking discoveries which have on occasion led from simple origins to the complex technical achievements of our time.

The stencil is next stretched on to a frame, and thus becomes a convenient and manageable device. If a piece of fine silk gauze is used instead of a stencil and is stretched across the frame, it may be converted into a stencil by painting out the ground portions of the pattern—the negative—thus completing in essence the silk-screen stencil or, as we now know it, the "screen".

The common form of screen now in use consists of fine bolting silk such as is used by millers, stretched tightly over and cemented to strong wooden rectangular frames; one such separate frame or screen is required for each color in a multicolored pattern.

There are several common methods of screen making. The simplest is to trace a design on to the silk and to paint out the portions not required. Another way is to paint or to print on to the screen a suitable resist in the required design, and after allowing to dry, to paint over the whole surface of the screen with a suitable lacquer. When this in turn is dry, the screen is washed with warm water, which dissolves away the resist, taking with it the

* Presented at meeting, London Section, Society of Dyers and Colourists, December 5, 1947. Reprinted from their "Journal," August, 1948.

lacquer, except in the unresisted portions.

Much the most important method is to make the screen photographically. The original design is first adapted to a suitable repeat, and is then traced on to a so-called negative; this is then reproduced photographically at the correct size on a screen surface which has previously been evenly coated with a gelatine solution of ammonium dichromate. Exposure of the screen and the negative to the rays of a powerful arc-lamp renders the gelatin insoluble, and a subsequent wash in hot water removes the gelatine mixture from the unexposed portion of the pattern. We thus obtain the screen in its simplest form. This screen could actually have a limited use for printing in this elementary state, though pin-holes would give trouble. Such screens are sometimes used for lacquer printing. But for textile printing, with ordinary textile colors, it is necessary to strengthen the insoluble gelatine so that it will withstand the wear and tear of the print shops. This is effected by lacquering one side of the screen and cleaning out with solvent from the other side, then lacquering the other side, turning over, and cleaning out with solvent once more.

Refinements and improved methods of screen structure and screen making have already been a feature of the industry—some printers and makers prefer metal frames, or metal frames lined with wood; the use of silk as the substructure of the screen has been supplemented by phosphor-bronze mesh, not always with success, since it is liable to dint. Many different screen lacquers have been tried, the most reliable being the chlorinated rubber base, while cellulose lacquers and metal paints are used on occasion. Sensitized polyvinyl alcohol has its uses instead of gelatine, and we can anticipate considerable advances in this aspect of screen-making technique in the next few years.

Screen printing is carried out on wooden or concrete tables supported by iron legs or brick pillars. The length of the table varies considerably, from about 30 up to 100 yd.

The method of printing is to spread the color evenly over the screen by means of a rubber or wooden squeegee. After such furnishing of the color, the screen is picked up and carried along to the next position, where exact fitting of repeat to repeat is effected by means of stops, which may be placed either on a rail on one side of the table or upon two rails, one on each side of the able. The accuracy of these rails is of paramount importance, and in some systems they are mounted on frames from the floor, separate and detached from the actual printing table. The whole length of the piece is traversed by the printer once for each color of the design. The squeegee may be operated by two workers, one on each side of the table, or by one man using a squeegee fitted with long handles.

There is no standard method of fitting up the surface of the table. We are told that a glass surface is used in Switzerland, that plastic table surfaces are used in Germany, and that in America the table is covered with a thin layer of wax, to which the cloth adheres sufficiently to permit multicolor printing and which calls for renewal no more than once a week. In Lyons the general practice is to cover the table with one or more woolen blankets and to combine the fabric on to the top blanket by means of a thin film of gum applied by a spray. In this country the woolen blankets are either covered by a calico back-cloth on to which the fabric may be pinned or covered with a waterproof wash blanket of rubber or American cloth on which the fabric may be gummed down. In another system the fabric may be combined elsewhere on to the backcloth, which is unrolled on to the table at will.

It is inevitable that there should be incessant efforts to modify the simple screen-printing process. The first object is the exact fitting of the pattern and the elimination of those irregularities which are characteristic of, and inseparable from, a hand operation. Thus it is common practice in France to place the screen in a carriage supported on double rails, the carriage moving easily from stop to stop and including a device for lowering the screen and raising it again at every stop. Several such devices are being designed by enterprising engineers in this country and generally include some form of control over the squeegee or doctor with the object of levelling out all irregularities in this vital part of the operations.

The main object in most schemes of mechanization, however, is increase in production. This may be achieved by the elimination of as much waiting time as possible, which, of course, can also be sought in the simplest of set-ups by arranging that the printer's attention is confined as far as possible to actual printing only, and that teams of service workers perform all other functions, such as putting down the fabric on the table, fetching color, etc. Some further saving is being sought by partial mechanization, particularly where long tables lead to fatigue. Organization of standard repeats and standard screen sizes can make a very appreciable difference in the time of setting up a pattern, which is a common cause of loss of production.

In the search for production by screen on a scale large enough to deal with roller-machine quantities, without the capital outlay of the roller machine and without the expense of the engraved copper roller, there have been several schemes for the complete mechanization of the screen-printing operation, and no doubt we shall see many more. In some of these the fabric, which may have been previously combined on to a suitable rubber sheet, is carried forward upon an endless belt and is printed by a battery of screens, up to a limited number arranged in series along the belt, which advances the cloth from screen to screen in an intermittent manner, while during each halt the squeegees of all the screens are made to operate. The synchronization of the squeegees and the coincidence of all the screens into position form the crux of the matter. If these are not carried out effectively the scheme becomes useless. Whereas in roller printing the fabric, subject only to its natural tendencies to shrink, advances from nip to nip, placed circumferentially round a central cylinder so that fitting is geometrically controlled, in the battery screen method the fitting is dependent upon a series of different positions upon a belt which is itself subject to intermittent motion; there is a hit-and-miss tendency which is difficult to put right. Attempts have been made to control the cycle of operations both electrically and mechanically, but so far with doubtful results. In this tendency to over-elaboration the first proviso of small capital outlay begins to be wanting. The next proviso of easy change of pattern and coloring, i.e. minimum getting-ready time, also is difficult to fulfill for getting ready is a far more protracted job on the battery machine than on the long table. Moreover, although the battery-screen print does not suffer from the "crush" effect of the roller print, nonetheless some trouble does arise from the subsequent screen pressing upon the previous prints, leading in some cases to contamination. Although the screen printer does not have scratches and streaks, his life is made adventurous with many other troubles. Nevertheless, the battery machine is equipped with one convenience which is difficult to obtain on a long table, viz. rapid drying of the fabric after leaving the printing belt by passing through a drier. This can be achieved without the complication of a hot printing room, which often occasions difficulty by causing the colors to dry up in the screens.

It is natural and consistent with the spirit of this mechanical age that we should not be satisfied with the hand process of screen printing. It is natural also that each operator entering upon screen printing should develop that particular system of screen-printing technique which best suits his own circumstances. If he is a block printer wishing to augment his field of operations and to secure a means of producing high-class goods in quantities beyond the capacity of his hand block printers, he will employ hand-screen and carriage-screen methods, probably on

tables of medium length, say 30-35 yd., and will not try to expand production more than can be dealt with by his ancillary plant, which will probably be rather primitive.

On the other hand, if the operator is a roller-machine printer, trying to collect some of that large field of business mentioned earlier, in quantities smaller than usual for the roller, and in novelty effects more striking than those of the machine, he will set up tables as long as possible and will equip those tables in the most suitable manner for high production, almost certainly with some form of carriage, and will above all take every possible advantage of the facilities for ancillary treatment which his roller printworks already gives him. If he has no room for long tables and his styles are not more than six colors or so, and if he is not afraid of mechanical over-elaboration, he will experiment with the battery-screen machine.

However, if the would-be screen printer is an entrepreneur who has heard of the wonderful possibilities of this art of screen printing, and would like to try it for himself, the author's advice to him is that "who sups with the devil must use a long spoon", and that he must be prepared to suffer many vicissitudes before he arrives at the stage of printing and a whole legion of disappointments after that.

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Aging Conditions—

(Concluded from Page 672)

effect of the operating variables indicated that if certain critical variables can be held at constant predetermined optimum values, full strength prints of very reproducible quality can be obtained. The experiment on continuous print aging proved that these factors can be held constant during continuous operation, yielding very uniform quality prints. The successful operation of the laboratory ager instrumentation in performing this function indicates that vat agers in general are capable of being instrumented to provide constant operating conditions automatically regardless of all external variables. Table IV summarizes the operating and instrumentation recommendations to achieve this purpose.

Acknowledgment

The author is indebted to R. Locke, W. A. Bain, Frances Galt, and E. T. Larson of the laboratory staff, and J. R. Bonnar, E. P. Sommer, F. F. Jacobs, and E. Channon of the staff of General Dyestuff Corporation, New York, for their valuable criticism and counsel as well as their assistance in obtaining some of the experimental data, and to Mrs. M. D. Reiner, who prepared the bibliography.

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List of Patents

B.P. 236,620	U.S.P. 975,349
282,133	1,663,845
312,423	1,663,846
334,069	1,738,946
371,690	1,738,947
421,237	1,818,041
422,117	1,819,051
486 070	1,861,623
498,082	1,861,624
	1,907,429
G.P. 248,186	
547,892	1,913,615
578,400	2,174,227

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Abstracts—

(Continued from Page 678)

cellulose has up to now been taken as evidence for the existence of carboxyl groups in the cellulose. This paper presents experimental data showing that as far as unmodified cellulose is concerned the titratable acidity is due to traces of the acid used in deashing. Even after prolonged washing, this acid is retained in the inter- and intramicellar spaces, and on treatment of the cellulose with dilute salt solution is released into the external solution.

A modification of the washing method, whereby a vigorous current of pure nitrogen is led through the system during the washing of the deashed material, permits complete removal of traces of deashing acid. After washing in this manner, no titratable acidity can be detected in unoxidized cellulose.

When this method is applied to oxidized cellulose, it is found that the wash waters contain organic acid oxidation products. Continued washing eventually removes these completely, so that the final wash water in contact with the deashed, oxidized cellulose has the same pH as the water being used for washing. When such a sample is added to a neutral salt solution, there is an increase in acidity of several pH units. The exact degree of acidity is readily determined by potentiometric titration.

During the course of these investigations it has further been found that when atmospheric oxygen acts upon cellulose in the presence of strong alkali, as in the viscose process, it does not cause any carboxylic groups to be formed on the cellulosic chains. From this on the other hand

the conclusion may be drawn that the mechanism on the cleavage of cellulosic chain molecules by air oxygen in an alkaline medium does not, as has been claimed by earlier investigators, involve the formation of carboxylic groups as products of oxidation.

STUDIES ON SOFTWOOD LIGNIN. Walter J. Schubert and F. F. Nord, Fordham University, New York 58, N. Y.

THE solution to the problem of isolating and studying lignin in unchanged form requires an approach that avoids high temperatures, and involves inert solvents. Brauns' extraction of "native lignin" seems to have met these requirements; however, only 3 per cent of the lignin was extracted by this method. Thus, the possibility of utilizing cellulolytic enzymes as a means for obtaining larger amounts of lignin presented itself.

Sound samples of certain softwoods were infected with members of the "brown rot" fungi, and the effects of the decay were followed by analyses of the residual material. Chemically unaltered lignin was then isolated from this decayed wood.

The effect of the action of the fungi, *Lentinus lepideus, Poria vaillantii,* and *Lenzites sepiaria* on white Scots pine and white fir was a depletion in the cellulose of the wood, concomitant with an increase in the relative content of lignin. After a limited period of decay, there was approximately a twofold increase in the yield of alcohol-extractable lignin, relative to that obtained from sound wood.

The "native lignin" of white Scots pine, and the lignin liberated from this wood by molds, appear to be identical. However, lignin preparations isolated with sulfuric acid, hydrochloric acid, or alkali do not resemble native lignin in chemical composition nearly so closely as the lignin obtained after enzymatic decay of the wood.

HYDROLYSIS AND CRYSTALLIZATION OF CELLULOSE. O. A. Battista, Chemical Research Department, American Viscose Corporation, Marcus Hook, Pa.

COMPREHENSIVE weight loss data and degree of polymerization data have been obtained for a variety of cellulose samples which were subjected to systematic hydrolysis. The variables of time, temperature, and acid concentration were studied over a wide range of conditions.

The use of mild hydrolyzing conditions for long periods of time results in a much smaller weight loss than is found with drastic conditions of hydrolysis for very short periods of time, even though the average degrees of polymerization approach the same leveling-off values in each case. The data are explained on the basis of two interdependent processes — namely, crystallization of the cellulose chains simultaneously with chain splitting by acid hydrolysis.

On the basis of the results obtained, mechanisms are proposed to account for the crystallization of cellulose under conditions of mild and drastic hydrolysis, respectively.

EXPERIMENTS ON THE REDUCTION OF THE CRYSTALLINITY OF COTTON CELLULOSE. Leon Segal, Mary L. Nelson, and Carl M. Conrad, Southern Regional Research Laboratory, New Orleans, La.

THIS paper deals principally with the application of anhydrous primary alkyl amines to cotton cellulose. Although some preliminary experiments with trimethylbenzyl ammonium hydroxide (Triton B) showed that crystallinity could be greatly lowered, it was not studied further because of the damage to the structure of the fiber which occurred.

The anhydrous alkyl amines cause more or less severe distention of the crystal unit cell, depending on the chain length of the homolog, but apparently little or no damage to the fiber structure. It was found that ethylamine applied to the fiber, followed by heptyl- or hexylamine, reduced the crystallinity to about 50 per cent. While the amine homologs above ethylamine are not effective directly, they act after a pretreatment by the lower amine. Hexylamine was also effective in a single mixture with ethylamine, provided the latter makes up 75 per cent by weight of the bath. The greatest reduction in crystallinity (to 23 per cent) occurred when ethylamine alone was employed.

It was found that crystallinities, greatly reduced by the amine treatments, were only slightly restored on immersion in boiling water for periods up to 3 hours.

X-ray radial traces of ground preparations of the treated samples confirmed in a qualitative way the conclusions of reduced crystallinities deduced from the acid-hydrolysis method. The decreased crystallinities of the amine-treated samples were likewise confirmed by moisture adsorption measurements after exposure to equilibrium at 81 per cent relative humidity.

Observation of photomicrographs of the cross sections of the amine-treated samples indicated considerable swelling of the cell walls as compared with the control cotton samples.

Amine treatments applied to 20/1 loose-twisted cotton yarn caused an increase of strength in all cases and over 20 per cent increase when the treatment was accompanied by stretching. Elongation was greatly increased except where tension was applied.

Practical implications of the results of the amine treatments are discussed.

EFFECTS OF ACID CONCENTRATION AND TEMPERATURE ON LIMITING DEGREE OF POLYMERIZATION OF COTTON AND RAYON CELLULOSES. Mary L. Nelson and Verne W. Tripp, Southern Regional Research Laboratory, New Orleans, La.

HYDROCELLULOSES were prepared from cotton linters and from viscose rayon by hydrolysis under a variety of conditions, using four concentrations of hydrochloric acid—namely, 2.5, 1.0, 0.1, and 0.01 N; two temperatures employed were 100° and 80°C. Percentage of residue, cuprammonium fluidity, and moisture regain at 81 per cent relative humidity were determined.

As has been found by other workers, there is an initial rapid lowering of the viscosity of solutions of the hydrocelluloses, corresponding to a decrease in degree of polymerization to a fairly low value which decreases only slightly on subsequent long exposure.

If the effects of temperature and acid concentration on rate of hydrolysis are taken into consideration, neither variable appears to affect the ultimate values obtained for this "limiting D.P." of either cotton or rayon; that is, if hydrolysis is continued for a time sufficiently long to cause 3 to 5 per cent weight loss by the sample, the same degree of polymerization value will be obtained under all conditions of hydrolysis studied.

Moisture regain was found to decrease with reduction in degree of polymerization, the change being pronounced for rayon, but not so great for cotton. It is suggested that part of the observed decrease in regain may be due to recrystallization of the amorphous regions (after some of the chain links have been broken) during the processing of the hydrocellulose after hydrolysis; and that only part of the decrease may be ascribed to actual loss of amorphous material by hydrolysis.

A "working definition" is proposed for the limiting degree of polymerization. It has been shown that when degree of polymerization is plotted against residue percentage, a fairly uniform relationship is found for cotton and rayon at both 80° and 100° and with all acid concentrations employed. This curve descends almost vertically at about 99 per cent residue, then turns and levels off in the region of considerable weight loss with very little concurrent decrease in degree of polymerization. It is proposed that the degree of polymerization corresponding to the beginning of this leveling-off region be used as a convenient, reproducible value of the limiting degree of polymerization.

TRADE NOTES • NEW PRODUCTS

• Dedication of Research Laboratories

The Atlas Research Laboratories were dedicated at Mertztown on August 20 as a memorial to the late Maximilliam F. Wirtz, who founded the firm in 1892. The ceremony was featured by the unveiling of a plaque in memory of the founder by his widow, Bernardine Wirtz Dorr.

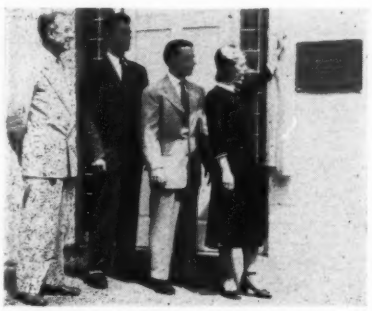
In an address "The Employee's Stake in Research", George L. Wirtz, President and son of the founder paid tribute to his father's vision and research ability. He related many incidents in the growth of the firm, a leader in the field of protective coatings, linings, cements and pipe jointing materials, and stated that "every item sold by the Atlas Mineral Products Co. was a result of Atlas research."

This company is said to be one of the few manufacturers of materials for chemical construction that supports a modern adequately equipped research laboratory.

Joseph A. Snook, General Chairman of the activities, opened the new laboratories for inspection by the employees and their families. The main office building and the Control Laboratory were also opened for this occasion.

The new laboratories are housed in a two story brick building with over 5,000 sq. ft. of floor space and are staffed by twelve chemists and technicians under the direction of Dr. Raymond B. Seymour, Technical Director, and Joseph Dahle, Research Director. A modern library with over 2,000 technical volumes and a research administration office occupy part of the second floor. The Control Laboratories now occupy a building in the plant area formerly used for both research and control. They are said to be adequately equipped for the investigation of the problems related to corrosion-resistant materials.

Part of the Staff of the Atlas Laboratories; Front Row: (l. to r.)—George Gabriel; Joseph Dahle, Director of Research; James Fry. Second Row: Carl DeLong, Willard Lantz, Walter Pascoe, William Rutter, Clifford Reinert, Richard Merkel and Carl Romig. Dr. Raymond B. Seymour, Technical Director, and Earl Erich were absent when photo was taken.



Unveiling of The Maximillian F. Wirtz Memorial Plaque; (l. to r.)—George L. Wirtz, Sr., son of the founder, Arthur F. Wirtz, Jr., and George L. Wirtz, Jr., grandsons of the founder and Mrs. Bernardine Wirtz Dorr, widow of the founder.

During the Open House, staff members explained the operation of physical testing apparatus, laboratory rubber mill, plastic molding press, electrometric titrimeter, Brookfield Viscometer, Spectrophotometer, laboratory homogenizer, SR-4 Strain Gauges and other specialized apparatus. It was also announced that a research project on the fundamental investigation of sulfur compound pipe joints was underway in cooperation with staff members of Lehigh University.

• General Mills Appointment

Fred B. Speyer has been appointed product development specialist in the Chemical Department of General Mills' New Products Commercial Research organization, according to W. E. Anklam, director of New Products Commercial Research.

For the past two years, Mr. Speyer has been director of Consulting Research Associates, Salem, Massachusetts, a consulting service which he organized in 1947.

Eileen Bonner Dwyer

John A. Waugh

Joseph B. Crowe

• New P. T. I. Faculty

Director Bertrand W. Hayward has announced the addition of new members to the Philadelphia Textile Institute Faculty for the 66th Fall Semester when the school opens in its new home in Germantown.

Miss Eileen Bonner Dwyer will be assistant librarian in the Edgar & Emily Hesslein Library on the new campus. Miss Dwyer received her A. B. degree from Trinity College in Washington, D. C. and returned to Drexel Institute of Technology in Philadelphia for her B.S.L. S. Degree.

John A. Waugh will be an instructor in cotton processing and manufacture. He received his education at Cumberland High School, Rhode Island School of Design, and I. C. S. He has served industry in the capacity of laboratory technician, overseer of carding and spinning, mill superintendent and research assistant to the head of Textile Engineering. He worked with the H. & B. American Machine Company, Lonsdale Co., Rhode Island Processing Co., Mt. Hope Mills, Inc., Edwards Div. of Bates Co., and the Institute of Textile Technology.

William Russell Watt will be instructor in the Chemistry Department. Mr. Watt attended Franklin & Marshall before he went into the Army. After his release from Army Service, Mr. Watt completed his work on his B. A. Degree in Chemistry at the University of Pennsylvania.

William Russell Watt

• Synthane Adds to Staff

Synthane Corp. of Oaks, Pa., manufacturer and fabricator of laminated plastics for industry, has transferred Edward W. Wilson from its Chicago office staff to the sales department, and has assigned him effective September 1 to the Milwaukee office as a direct sales representative assisting Howard A. Tyner. Mr. Wilson, a product of the University of Kentucky, came to Synthane Corp. from the Chicago offices of Western Electric Company. His appointment represents the second increase in the Synthane sales force since June 1.

• Revised Synthetic Resins Bulletin

A revised edition of the technical booklet describing properties and uses of synthetic resins is now available from Hercules Powder Company, Wilmington, Del.

A key to specific uses for Hercules synthetic resins is provided by a chart which matches the resins with their actual and potential uses. From this index the formulator who is faced with a resin problem is said to be able to pick out the resins indicated for use in a particular field. Study of the properties of the desirable resins only and quicker selection of the resin or resins best adapted to needs is claimed possible.

Resins described in this booklet are used in the manufacture of protective coatings, adhesives, printing inks, linoleum and floor tile, asphalt compositions, essential oils and fixatives, sizes for paper and textiles, binders for flameproof compositions, and many other products.

• New P. & G. Department

Procter & Gamble announces the establishment of a new bulk products sales department which will take over the marketing of the company's processing and finishing products for the textile industry. Joseph B. Crowe, who for 23 years has been associated with the company's textile research and customer service departments, has been named manager.

J. G. Parry, Manager of Procter & Gamble's Bulk Sales Departments, in his announcement, pointed out that "the formation of this new sales department will make it possible for Procter & Gamble to serve the textile industry more effectively and put at the disposal of textile manufacturers our years of research in this field."

Mr. Crowe was graduated from Lowell Textile Institute with a B.T.C. degree in 1925. After a year on the teaching staff at Lowell, he joined Procter & Gamble at Cincinnati and was almost immediately given the task of organizing a textile research laboratory in Paterson, New Jersey.

To his duties as Manager of P&G's Textile Detergents and Finishes Sales Department, Mr. Crowe brings a wealth of experience. In addition to his years of textile work he has, for a number of years, been a member of the Advisory Committee of the Soaps & Detergents Section of the American Society for Testing Materials.

• Plantinga Joins J. & J.

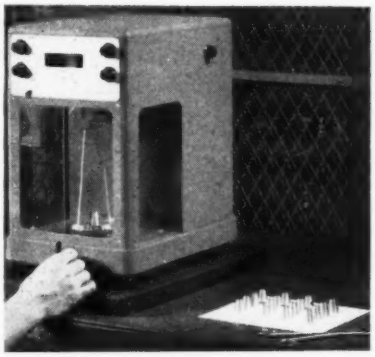
Dr. Oliver S. Plantinga has joined Johnson & Johnson, New Brunswick, New Jersey, as Director of Cotton and Gauze Research according to an announcement made by Dr. W. H. Lycan, J. & J. Research Director. Dr. Plantinga was previously Plant Manager of the Chemical Division of the Marathon Corporation at Rothschild, Wisconsin.

• Fisher Gram-atic Balance

Weighing samples for moisture content, etc., to 1/20 of a milligram with analytical balance accuracy, but in one-third the usual time is said to be made possible by a new direct-reading instrument called the "Gram-atic Balance."

The new balance has only one pan, and the weight reads directly on a scale at eye level, eliminating a usual source of error in adding up individual weights. The balance has all required weights built-in and manipulated by turning four external knobs. No weights are handled, weights less than 0.1 gram are indicated optically and automatically. Total weight is read directly from a scale on the instrument panel. The sample to be weighed can range from 200 grams (approx. 7 ozs.) to 0.0001 gram.

Because of its speed and simplicity of operation, the new balance is ideal for production control at test stations in textile plants, it is stated. The sturdy construction and elimination of the adding-up of individual weights greatly reduces training time for operators.



Fisher "Gram-atic Balance"

• Bulletin on Caustic Soda

A new edition of Solvay Technical and Engineering Service Bulletin No. 6, *Caustic Soda,* has been released by the Solvay Sales Division, Allied Chemical and Dye Corporation.

This 80-page technical bulletin, the newest in Solvay's series, contains information on the properties of caustic soda and its solution; the nature and advantages of liquid caustic soda, plus the latest data on its unloading and handling. The text is illustrated with photographs, tables, graphs and diagrams.

Bulletin No. 6, *Caustic Soda,* is available without charge from the Solvay Sales Division, Allied Chemical and Dye Corporation, 40 Rector Street, New York City 6, New York.

• 16 New Dyestuffs

Sixteen acid and basic dyestuffs have been added to the list produced by Hilton-Davis, Cincinnati, at its plant on Langdon Farm Road, Cincinnati.

They are: Hidacid Phloxine B (C.I. 778); Hidaco Caribbean Blue Concentrated (C. I. 663); Hidaco Basic Blue 10 G. Concentrated (C.I. 658); Hidacid Metanil Yellow (C.I. 138); Hidacid Light Yellow 2 G. (C.I. 639); Hidacid Orange II Concentrated (C.I. 151); Hidacid Fast Orange G. Extra Concentrated (C.I. 27); Hidacid Brilliant Crocein Scarlet Concentrated (C.I. 252); Hidacid Fast Crimson Extra Concentrated (C.I. 31); Hidacid Azo Rubine Concentrated (C.I. 179); Hidacid Fast Scarlet 3 R (C.I. 185); Hidacid Resorcin Brown R Concentrated (C.I. 235); Hidacid Blue Black Concentrated (C.I. 246); Hidacid Naphthalene Green (C.I. 735); Hidacho Malachite Green Base (C.I. 657) and Hidacid Wool Green Concentrated (C.I. 737).

• Compton Heads Chemistry Division

The appointment of Dr. Jack Compton as head of its Chemistry Division has been announced by the Institute of Textile Technology of Charlottesville, Virginia.

Dr. Compton is a native of Alabama and received his Ph.D. in organic chemistry from Ohio State University. He has done post-doctorate work at McGill University and has been employed by Rockefeller Institute and Boyce Thompson Institute in fields related to cellulose research. He was with B. F. Goodrich Company in their textile department for four years, and latterly with the Celanese Corporation of America at their Rome, Georgia, plant for five years. Dr. Compton is author and co-author of a number of publications in the field of organic chemistry. He is a member of the American Chemical Society, American Association for the Advancement of Science, and a fellow of the American Institute of Chemists. Dr. Compton will assume his duties at ITT on August 20.

• Rayon Fabrics Standardization

Thirty-five trade associations representing companies in the wearing apparel and accessories field have been invited by the National Retail Dry Goods Association to take part, with the technical groups already participating, in the development of standards for rayon fabrics suitable for use in men's and women's clothing. The work is being done under the procedure of the American Standards Association, sponsored by the National Retail Dry Goods Association. The proposed standards will be for rayon fabrics composed of more than 50 percent rayon and will be based not on construction specifications but on minimum performance requirements for end use.

The first meetings of subcommittees on women's wear and on men's wear were held August 10, August 17, and September 15. Other meetings are scheduled as follows: *Men's Wear:* October 20, November 10, December 15 and January 12. *Women's Wear:* September 21, October 5, November 2, December 7 and January 4.

• New Celanese Booklet

A new booklet, "The Cleaning, Dyeing and Finishing of Garments and Fabrics Containing Celanese Yarn," has been published by Celanese Corporation of America. The booklet is designed for the purpose of assisting the cleaner and dyer in the successful handling of apparel and home furnishings made from fabric consisting wholly or in part of Celanese yarns or fibers.

The text of the publication was prepared by the technical staff of Celanese Corporation of America in collaboration with the technical staff of the National Institute of Cleaning and Dyeing.

• New Paulden Manager

Edward H. Staab has been appointed general manager of Paulden Laboratories, Inc., Carlstadt, New Jersey. He is now in charge of coordinating the research work of this firm of textile processing consultants with the requirements of the textile processing plants throughout the country.

Previous to his appointment, Mr. Staab was connected with the National Aniline Division, Allied Chemical & Dye Corp., in a technical and sales capacity.

Edward H. Staab

• Flame-Resistant Fabric Chemical

Discovery and development of a flame-resistant chemical for cotton and rayon fabrics, is announced by the Du Pont Company. When properly applied, it is said to give those fabrics a flame resistance which is durable to dry-cleaning, normal home laundering, and weathering, but which does not change the appearance or hand of the material. It has been given the trade-mark "Erifon."

When rayon and cotton fabrics are properly treated with "Erifon," they will not support combustion and the flame retardance will last the life of the fabric despite frequent dry-cleaning or normal home laundering and exposure to rain and sun, it is claimed. The degree of flame-resistance achieved is said to surpass the most exacting fabric flame tests of government and industry.

A flame held to treated material will char the fabric at the point of contact, it is stated, but the flame does not spread.

Tests are said to indicate that the retardant remains effective in fabrics after more dry-cleanings and normal home launderings than they would usually receive in their lifetime. However, it is not durable to the acid sours and alkalies customarily used in commercial and industrial laundries.

"Erifon" flame retardant does not adversely affect the "hand" nor does it change the draping qualities of materials; neither does it stiffen or weaken them, and at most adds only 15 per cent to the weight, it is stated. It is further stated that fabrics treated with "Erifon" have no irritating effect on the skin.

Many types of cotton and rayon materials as well as cotton yarns have been successfully treated on a commercial scale. These include cotton sheeting, flannels, chenille yarn, twills, poplins, ducks, rayon marquisettes, plushes, napped knit fabrics, napped woven fabrics and others. Research work is continuing in an effort to make the process satisfactorily applicable to other types of fabrics, cotton and rayon staple, and continuous fllament rayon yarn.

"Erifon" gets its durability from its chemical reaction with the cellulose molecules of rayon and cotton. This also accounts for the fact that it does not change drape, hand, or strength and does not cause stiffness. It is not a coating. It is a solution of titanium and antimony salts. The theory about the product is that it reacts with cellulosic molecules and is locked into the structure of the fibers, rather than merely coating the surface. It is said to change the fibers chemically but cause no change in physical properties.

Development of "Erifon" flame retardant stems directly from fundamental research started in the early years of this decade at the Du Pont Experimental Station at Wilmington. This development is now out of the laboratory stage and is going through the commercial development phase. Du Pont scientists as well as those in the textile trade are continuing their research to adapt it to all cotton and rayon fabrics on a commercial basis.

Its application must be done so precisely that it can be handled only in textile mills. Some extra equipment is needed in most mills to apply the chemical. The skill required for satisfactory application is considerable. Most technical problems of commercial application have been worked out, although individual mills may run into problems of their own in starting operations with "Erifon."

Most of the research and development on "Erifon" flame retardant was accomplished by the Du Pont Pigments Department, which has had extensive experience with titanium in its production of pigments. The chemical is being manufactured by the company's pigment plant at Newport, Del., with facilities which are considered adequate to supply any foreseeable demand.

Although the price of "Erifon" in liquid form is 25 cents a pound, materials and garments treated with it are likely to be expensive because the application is difficult and relatively costly. For this reason, it probably will not affect the use of existing temporary type of flame retardants for purposes in which durability is not a factor. The temporary types are considerably less expensive and fully satisfactory for many uses.

• Photoelectric Control

Photoswitch Incorporated, 77 Broadway, Cambridge 42, Mass., announces the availability of a new high speed sensitive Photoelectric Control Type 23LF3. The control is used for various inspection applications. It is said to detect the presence of seams and blemishes in textile sheeting material and inspect for proper labeling on bottles and packages.

Photoelectric Control Type 23LF3 is supplied with Scanner Type 42KK1. The scanner consists of light source phototube and amplifier tube in a single small housing of unique design. A common lens system is used resulting in the smallest and most simply installed scanning head available to industry, it is stated.

The scanner is wired to Control Type 23LF3 with standard code-approved wire (no special shielded table is required). The control is said to consist of a power supply providing alternating current to the light source and direct current through a rectifier tube to the phototube and a two-tube amplifier system. It is important to note that Type 23LF3 is the only photoelectric control of its type available which uses long-life extremely reliable vacuum tubes throughout the amplifying system and does not require gas-filled thyratron-type tubes, the company states.

Photoelectric Control Type 23LF3

It is further stated that Photoswitch Control Type 23LF3 is designed to operate in any small sudden change or "bump" in the quantity of light which reaches the photoelectric tube. The light is claimed to originate at the light source lamp and is projected through the lens system as an intense spot of light on the material to be inspected; the light is reflected from the material passing back through the same lens system to the phototube. Any sudden change in the reflected light is said to be caused by either a mark which has been printed on the material for the purpose of indexing an operation or from some abrupt change in the thickness or appearance of the material.

Bulletin PD 476 is available on the product.

• Sankey Sales Associate

Harry Sankey, formerly with American Aniline Products is now associated with Woonsocket Color and Chemical Co., Woonsocket, R. I., and will be handling sales to rayon and cotton accounts in New England.

Prior to his association with American Aniline Company, Mr. Sankey had experience in package dyeing of vats and naphthols at Woodlawn Finishing Company, Glenlyon Yarn Dye Company, Cook Yarn Dye Works, and Hope Webbing Company.

• Fabric Stability at 165°F.

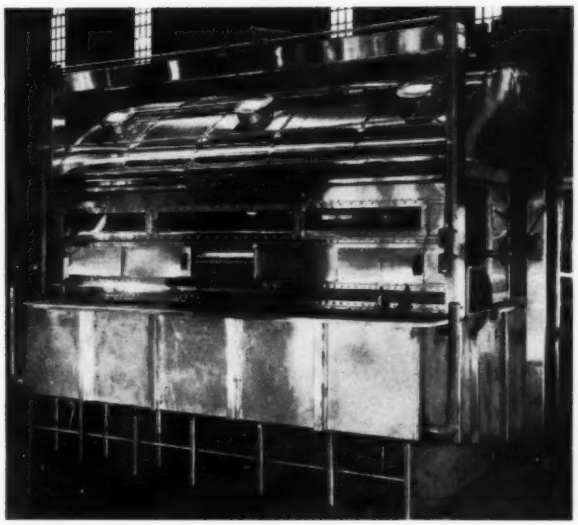
A new finishing treatment which is said to preshrink polyethylene fabrics to less than two per cent residual shrinkage at temperatures up to 165°F. has been developed by American Viscose Corporation. This, it is believed, removes the last barrier from the widespread use of polyethylene fabrics in automobile seat covers, as well as in upholstery generally, in handbags, luggage, shoes, women's hats, draperies, and various other applications.

The new method of heat stabilizing these fabrics was worked out by the corporation's chemical and textile research departments in Marcus Hook, Pa. It consists of first treating the fabric in a semi-relaxed state with hot water, hot air or steam. This is said to permit shrinkage in both warp and filling. After shrinkage, the fabric receives a brief steam treatment on a decating machine to make it more uniform and flexible. When a final smooth surface is required, as in seating fabrics, calendering is recommended. The new treatment produces a fabric claimed to be of pleasing hand and flexing quality.

According to William P. Crawley of Avisco's textile research department, all three operations (preshrinking, decating and calendering), can be done at reasonable cost on commercial equipment. He adds that abbreviated versions should be satisfactory provided they give the required stability in both warp and filling directions. "Even though uniformity is maintained in quilling and weaving tensions," he warns, "some puckering may show up when the fabric is preshrunk in a relaxed or semi-relaxed condition." This undesirable effect is easily removed, it is stated, by treating the fabric for a brief period with steam at 212 degrees Fahrenheit, on a decating machine.

"Careful control must be exercised," Mr. Crawley says, "in applying the heat-stabilizing treatment, to obtain the desired amount of stability and prevent spoiling the fabric by too much shrinkage. Less than two per cent residual shrinkage is obtained normally in automobile seating fabrics by preshrinking them 6 to 10 per cent, but the exact amount of processing shrinkage is dependent upon the weave and the amount of tension the filament has been subjected to in weaving."

American Viscose Corporation has been producing polyethylene monofilament on a limited scale for the last two years. During that time the various problems of its production and use are said to have been under intensive study by the corporation's chemical and textile research departments.



Stainless Steel Dyebox

• New Dyebox Reel Supports

A new development in the fully enclosed stainless steel dyebox (S. Blickman, Inc., Weehawken, N. J.), is the all stainless steel welded oval reel supports which replace cast iron. These supports are independent of the box and transmit load directly to the floor.

The box has safety glass windows on all four sides for complete visibility. Counter-balanced doors at front and rear are said to allow quick one-hand opening for access to the interior. Heat and moisture are kept inside the box where they belong resulting in a better control of the dyeing operation and in savings of steam, water and dyestuffs, it is stated.

It is further stated that the stainless steel tub is built with round corners to allow rapid, easy cleaning.

• New Brownmil Product

A new product, called CC-101, which it is claimed, will tend to eliminate redyeing is now being merchandised by Brownmil Ltd., 114 Greenpoint Avenue, Brooklyn, N. Y. Made with coffee and other ingredients, CC-101 is said to be neither saponified nor sulfonated. CC-101 is said to possess outstanding qualities of leveling, softening, penetrating, deodorizing and the natural bleaching properties of textiles.

The action of CC-101 in the dye bath is claimed such that it will retard the dyestuff at the beginning of the bath until such time as the fibers have been conditioned to absorb the dyestuff. This action is important in eliminating streakiness and uneven dyeing.

Brownmil states, "From practical experience with the textile chemist, dyer and finisher, we find the following results have been obtained with the use of CC-101 in the dye bath:—

1. Even and level dyeing, 2. A softer and fuller hand to the goods, 3. A brighter, bloomier and clearer dyeing, and 4. A Saving in chemical costs."

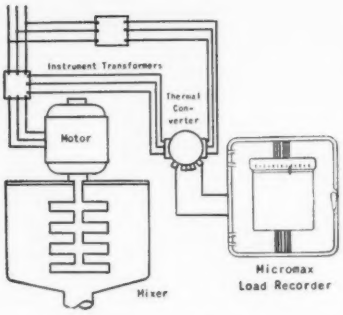
It is said that CC-101 may be easily used by itself, or with a small amount of sulfonated fatty alcohol or similar product.

The company suggests CC-101 may be used in the following proportions and manners:—For the jig, in water running from zero grains hardness to approximately 8 grains hardness and on goods consisting of nylons, spun rayons, acetate rayon mixtures, acetates, plied yarns, and ninons, as well as light cottons, use ½ lb. to 1 lb. of CC-101 to the dyebath before the dyestuff is added plus 4 ozs. of sulfonated fatty alcohol to 8 ozs. of sulfonated fatty alcohol if a good head of foam is desired. For heavier materials adjust the CC-101 formula to the weight of the goods to be dyed. Where the water exceeds 8 grains hardness add the necessary amount of phosphates.

For the dye box, for the same classifications of fabrics, use 2 to 4 lbs. of CC-101 to the box of approximately 1200 to 1500 yards.

The indication for use of CC-101 on the padder is said to be good because it is claimed CC-101 will completely disperse the dyestuff, give very little foam, not allow the dye liquor to break down, will rinse quickly and when the proper amount is used, the dyestuff will be retarded long enough to eliminate shading and streakiness.

Several firms are said to be already using CC-101.



Micromax Load Recorder

• Micromax Electrical Load Recorders

Leeds & Northrup Company, 4934 Stenton Avenue, Philadelphia 44, Pa., states that viscosity of materials in mixing or other types of agitating machinery can often be measured indirectly by measuring the power input to the electrical motor which drives the mixer. It is further stated that in many processes of this type, the materials must be mixed to a given viscosity, or until a definite reaction end point is reached where viscosity undergoes an abrupt change. By experience, it is claimed that viscosity can be related directly to motor input in kilowatts.

For such applications, Leeds & Northrup Micromax instruments are being used in a number of plants. The method of installation is straightforward. A thermal converter is connected in the power leads to the drive motor, and converter output is wired to a potentiometer-type Micromax Load Recorder. The instrument is claimed to continuously record motor input in kilowatts or on some arbitrary scale supplied by the user.

When so desired, the Micromax is equipped to operate alarms on signal lights which inform the machine operator when the end point is reached. For some processes, it is said that the Micromax can be supplied to provide automatic control, generally by regulating feed of process material. It is also stated that where several machines are operating in one shop, data from all of them can be recorded on a single Micromax multiple-point instrument.

Micromax instruments used for this application are said to be standard equipment of the same basic type that power plants have used for years for both local and remote measurements of electrical load. The thermal converter, although amply fast-responding to show significant variations, is said to smooth out the usual erratic variations in motor load and show a true average which permits accurate analysis of trends. Because the potentiometer method is used for measurement, distance between thermal converter and the Micromax recorder is claimed to have no effect on accuracy of measurements.

For further information, write to Leeds & Northrup Company.

• Site for New Plant

Tennessee Eastman Corporation announces that a site has been selected in Gregg and Harrison Counties near Longview, Texas, for the erection of a plant to manufacture certain basic raw materials for use in operations at Kingsport, Tennessee.

James C. White, president of the corporation has stated, "Deeds are being taken covering a large tract of land along the Sabine River near Longview, bringing to a conclusion the consideration given to a number of possible locations over a period of several months."

Factors considered in the selection of the site were said to be nearness of raw materials such as oil and natural gas, the availability of a suitable water supply, satisfactory transportation facilities, high-caliber manpower, and good living conditions.

Quantities of basic chemicals will be manufactured in the new plant at Longview, it is stated. Construction of the first manufacturing unit will commence upon completion of engineering design and initial operations are expected to start late in 1950.

• Joins General Aniline

Dr. Bernard Rudner recently joined the technical staff in the P.D. Intermediate section of the Rensselaer, N. Y., plant of General Aniline & Film Corporation. He came directly from Northwestern University where he received his Ph.D. in organic chemistry. He received his B.S. in chemical engineering at Lafayette College in Easton, Pa., and was employed as a research chemist with Parke, Davis & Company, Detroit, Michigan, before returning to school for his doctorate.

• General Electric Bulletins

The following six bulletins dealing with G-E electric equipment for the textile industry are available from the General Electric Company, Schenectady 5, N. Y.:

GEA-5010 on Textile Range Drives.

GEA-5011B on Loom Motors.

GEA-5012 on Center-Wind Batcher Drives.

GEA-5214 on Tenter-Rail Guiders.

GEA-5258 on Adjustable-Speed Warper Drives.

GEA-5259 on Slasher Drives.

• Fairleigh Dickinson Textile Courses

The Textile Advisory Board of Fairleigh Dickinson College in Rutherford, New Jersey met last month to revise the program of courses leading to the Associate in Arts Degree in Textiles being given this year at the college. The Board made final arrangements for the opening of the newly equipped Textile Laboratory and for the publication of supplementary materials to be used in the courses.

Practically all of the instructors of these courses were former instructors of the Textile courses at Columbia University. Herbert Mauersberger, head of Textile Book Publishers and formerly in charge of Columbia's Textile courses, teaches the course in Raw Materials on Monday evenings.

Dr. Marcel J. Pagerie, who is Chemical Director at Atlantic Dye Works, teaches the course in Finishing on Tuesday evenings. Charles Minoff, Chemist at Martex Printing Company, and Herman P. Baumann, Chief Chemist at United Piece Dye Works, are teaching Textile Chemistry on Thursdays.

George Decnyf, Supervisor of Dyeing at United Piece Dye Works and member of the Faculty of the Philadelphia Textile Institute, is giving the course in Dyeing and Printing on Wednesday evenings. Gordon R. Turner, Director at United States Testing Corporation, is teaching the course in Textile Identification, Analysis, and Testing on Wednesday evenings.

Classes begin this week; registration for these courses having taken place Monday through Friday evenings at the College offices from September 1-16. With the cooperation of industry, members of these classes will supplement class work with active visits to textile plants in the area, it is stated. A collection of illustrative material and visual aids has also been started in connection with these courses. A limited number of partial scholarships are available for full-time day-evening program students and for part-time evening students.

In addition to the instructors listed above, members of the Textile Advisory Board at Fairleigh Dickinson are: Carl Brubaker, Research Director at Standard Bleachery and Printing Company; Nathan Caress, Personnel Director at Waldrich Company; Marinus C. Galanti, Personnel Manager at United Piece Dye Works; F. R. Haigh, Chief Chemist and Director of Chemical Operations at Botany Mills; and Werner Von Bergen, Director of Research at Forstmann Woolen Company.

Fairleigh Dickinson College is reached by the Inter-City Bus which leaves from 43rd Street, New York, just off Times Square, or by the Erie Railroad. The college is fully accredited in both New York and New Jersey.

• Awarded Good Housekeeping Approval

Boconize, a moth-proofing process has been awarded the *Good Housekeeping* magazine Seal of Approval, it was announced recently. It is stated that the magazine's endorsement, which carries with it a refund or replacement guarantee, was given to Boconize only after exhaustive laboratory tests proved that hungry larvae placed on treated fabrics for 28 days, left it undamaged.

It is claimed that other Boconize advantages proved in the tests include its odorless, colorless, non-allergic, non-toxic characteristics, and its resistance to effects of light, heat, perspiration or salt water. When used in the mill or factory, it can be applied before, during, or after the dyeing operation.

• New Heyden Chemicals

Heyden Chemical Corporation is announcing a group of new products to be made available to interested concerns in pilot plant quantities. These chemicals will supplement the standard products manufactured in the company's plants and will, to a large extent, be derived from them.

The first of these new items will be anisic acid, anisoyl chloride, ortho-chlorocinnamic acid and 4-4'-dichlorobenzophenone, the first two of which are available in commercial quantities, As "building materials" which have not heretofore been generally available, they will be of interest to chemists in various fields. Most of the new items will be made in the fine chemicals manufacturing unit which was constructed not long ago at the Fords, New Jersey plant of Heyden.

• U. S. Dyestuff Appointments

In addition to three appointments made to succeed the group which recently resigned to form the Organic Chemical Corp., U. S. Dyestuff Corp., Boston, announces that two more chemists will be taken on. One of these will be in the Philadelphia office, and the other at the Providence office, soon to be established.

The three appointments were Fred Allen, formerly superintendent of dyeing at River Mills Corp., Fall River, Mass., the new head of the forementioned Providence office; Joseph Macneil, formerly in charge of the Philadelphia office and laboratory, becomes the new chief chemist; and Michael Maguca, formerly assistant chemist of Hayward-Schuster Woolen Mills Co., who becomes demonstrator.

• Du Pont Dye Price List

The Du Pont Company, Wilmington, Del., has released its fall price list on dyestuffs. The list includes downward revisions on a considerable number of prices, amounting to as much as eight per cent on some individual products. The new prices were made effective as of August 17.

• Silicate Booklet

A new 20-page, pocket-size manual reviewing its silicate of soda products has been issued by Diamond Alkali Company, Cleveland, Ohio.

This booklet, said to be conveniently designed for quick reference and to save reading time, for production and purchasing executives, concisely describes 10 "standard" grades of Diamond liquid silicates of soda commercially available. Data presented on each grade summarizes its principal physical properties, major industrial applications, basic advantages provided, and size and net weights of packages.

Allied products similarly treated include Diamond's special concrete silicate, used to cure concrete and to harden concrete floors; silicate of soda glass, for rust protection in water piping systems; special liquid silicates of soda, to meet special industrial processing requirements; and three grades of granular silicate of soda which find wide usage in cleaning compounds, textile mills, paper mills, and as detergents.

Supplementing this factual information are helpful comparison tables covering specific gravity, temperature correction and fahrenheit-centigrade relationship. Copies of this literature are available upon request to the company's nearest district sales office or general headquarters, 300 Union Commerce Building, Cleveland 14, Ohio.

• Bulletin on Combustion Safeguard

The Bristol Company, Waterbury 91, Conn., has published a bulletin, No. W1816, describing its new combustion safeguard, known as the Bristol Electronic Pyrotrol. The new bulletin describes the application of the Pyrotrol in protecting gas-fired ovens, furnaces, kilns, boilers, dryers, kettles, and other similar industrial heating equipment from the danger of gas explosions during ignition, operation, and shut-off.

Copies of the bulletin are available from The Bristol Company.

• Electronic Power Supply

The Coleman No. 6-054 Electronic Power Supply is a voltage regulating device designed by Coleman Instruments, Inc., 318 Madison St., Maywood, Ill., for use with photo-metric instruments employing low voltage lamps, or other devices requiring a perfectly stabilized source of low voltage power.

Delivering precisely regulated voltage at 6.2, 8.5 and 10.0 volts, A.C., it is said to be possible to connect it to alternating current of any voltage between 95 and 135 volts, and any frequency between 55 and 65 cycles. Its output voltage will remain stable to within less than ±0.2%, even though both input voltage and imput frequency vary over these wide limits, it is claimed. It is also claimed that if the input voltage range is restricted to 100-130 volts, the Electronic Power Supply may also be at frequencies of 49.5 to 50.5 cycles.

Housed in a case finished in grey wrinkle, the No. 6-054 Electronic Power Supply is equipped with a three-position switch for selection of output voltage and is furnished with a 6 ft. line cord. Output voltage is brought out through a 6 ft. instrument cord terminated in a plug designed to mate with the special receptacle employed in Coleman Photometric Instruments. A special adaptor, No. 6-055, is available to permit use of the Electronic Power Supply with other devices or with instruments not equipped with the special Coleman receptable.

The Coleman Electronic Power Supply is said to offer these advantages: stabilized voltage at 6.2 volts, 8.5 volts or 10.0 volts, R.M.S. A.C., accurate stabilization of output voltage against wide variations of Input Voltage and/or frequency, trouble-free opertion—No Maintenance, standard vacuum tubes, conservatively operated and easily replaceable and operation at either 50 or 60 cycles.

Bulletin B-218 describing the instrument in more detail can be obtained by writing to Coleman Instruments, Inc.

Electronic Power Supply

• Safety Congress Convention

A panel discussion on physical safeguards will highlight the opening textile session of the National Safety Congress, 37th annual convention of the National Safety Council, to be held October 24-28 in Chicago.

Neil Nelson, district engineer of American Mutual Liability Insurance Co., Manchester, N. Y., will lead the panel discussion. He is program committee chairman of the Council's textile section and in charge of all Congress textile sessions.

Panel participants will include L. A. Faulkner, supervisor of machine guards for Liberty Mutual Insurance Co., Boston, Mass.; Arthur A. Kinsman, safety director of Crown Manufacturing Co., Pawtucket, R. I.; Robert M. Jones, executive engineer of Saco-Lowell Shops, Biddeford, Me., and S. W. Quisenberry, manager of maintenance sales for E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.

Another feature of the first textile meeting will be a discussion of safety training and testing programs by M. DeMilt Aird, supervisor of testing for Revere Copper & Brass, Inc., Rome, N. Y. Mr. Aird and his associates have developed a cartoon series that are said to enable the discovery of accident proneness among employees.

Dr. James Sterner, Eastman Kodak Co., Rochester, N. Y., will lead off the second textile session with a talk on control of dermatitis in the textile industry. Hazardous chemicals used in the synthetic fiber industry will be discussed by William D. Owen, assistant chief engineer of Visking Corp., Chicago, Ill. D. J. Moffie, head of the department of psychology of North Carolina State, Raleigh, N. C., will talk on psychology and accident prevention.

The final textile meeting will be highlighted by a talk on the essentials of accident control by R. L. Rogers, vice president of Textron Southern, Inc., Anderson, S. C. An illustrated discussion on materials handling in the textile industry will be made by S. R. Brookshire, Engineering Sales Co., Charlotte, N. C. The chief of safety branch for Mohawk Carpet Mills, Amsterdam, N. Y., Charles L. Trommer, will end the session with a talk on safety practices through visual education.

The meetings of the textile section will be held in the Congress Hotel, one of six Chicago hotels that will house National Safety Congress activities.

• Butterworth Building Plans

Harry W. Butterworth, Jr., President of H. W. Butterworth and Sons Company, Philadelphia, Pa., has announced that plans are now under way for the building of a new foundry and additions to their machine shop and storage facilities at their plant in Bethayres, Pennsylvania.

The new building program is the outcome of a survey recently completed by a firm of management engineers (Stevenson, Jordan and Harrison), employed by Butterworth to study their manufacturing and handling costs. The program, as recommended by the engineers, has been approved by the Board of Directors and work is now under way. A tract of twenty-two acres along the Reading Railroad tracks at Bethayres is being used for this expansion program.

The building program, it is said, will increase Butterworth foundry facilities approximately twenty-five percent. By having foundry and machine shop operations in close proximity, it is expected that the time element in production will be greatly reduced and quicker deliveries will be possible. When this consolidation of production facilities is completed, the Butterworth plant in Providence, R. I. will be closed. It is expected that this consolidation will be completed by June, 1950. The Providence plant has been operated by Butterworth since their purchase of Textile Finishing Machinery Company in 1944.

• Handbook on Cotton Warp Sizing

E. F. Houghton & Co., manufacturer of industrial oils, chemicals and leathers, has just issued a new publication for the textile industry. Titled "A Handbook on Cotton Warp Sizing," the new book is the work of the Houghton Textile Research Staff and is aimed at helping to improve textile processing efficiency.

The book is the second edition and is said to be a complete revision of the first which was published in 1938. Since that time there has been considerable progress in this field and the addition of thousands of employees in textile mills that were completely unaware of the techniques of warp sizing 11 years ago, the company states. It is further stated that the handbook is designed to fill a place in the textile processing cycle between the grading and preparation of cotton (which are touched on lightly) and the weaving and merchandising of the fabric.

The book contains a chapter on starches, one on sizing of synthetic warps, as well as chapters on the purposes and mechanics of warp sizing. Considerable space is devoted to the control of the various processes. It is indexed for easy reference.

Any textile mill executive or department head may receive a free copy of the book upon request to E. F. Houghton & Co., 303 W. Lehigh Ave., Philadedphia 33, Pa.

• 1950 Spring Rayon and Woolen Cards

The regular editions of the 1950 Spring Rayon Card featuring Blossom Pastels and Happytones and the 1950 Spring Woolen Card highlighting Horizon Pastels and Sand and Sea Colors have just been released to members of The Textile Color Card Association, it was announced by Margaret Hayden Rorke, managing director.

Especially important among the basic color families are the rust, copper and henna shades, as well as yellow and golden tones. String and burlap beiges are strong neutrals while the latest "greys" have a bluish cast. Browns are of warmer tones of hazelnut and praline.

Navy blue and medium blue in butchers are active while Duck, aqua and turquoise also have a firm place in the fashion forecast. Most popular "greens" include yellowish pineapple, mint, bluish saltwater and frosted shades while "reds" are represented by grenadine, blue-toned peppermint and jelly shades, and vibrant orange (for sports).

The advance Spring color collections also include orchid, mauve and heather violet tones.

OBITUARY

T. L. B. LYSTER

T. L. B. Lyster, 70, formerly chief engineer of the Hooker Electrochemical Company, Niagara Falls, N. Y., died August 18th of a heart ailment after a short illness.

At the time of his death, Mr. Lyster, an industrialist and art patron, was a consulting engineer for the Hooker Company. In 1907 he came to the company as a construction engineer when it was known as the Development and Funding Company.

During World War I, he joined the Army Engineers Corps becoming a lieutenant colonel before returning to Hooker in 1919 as director of development. From 1922 to 1932 he devoted a large part of his time to the pulp industry serving as a consultant to Hooker in the meantime. From 1937 to 1948 he was chief engineer.

Mr. Lyster was a member of the Niagara Falls Board of Education and a director of the Little Theater Inc., and was an active yachtsman. He was also a member of many professional organizations, including the Chemists' Club of New York City, the Society of Professional Engineers, the American Institute of Chemical Engineers, the American Society of Mechanical Engineers, and others.

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Technical GLYCERINE NEWS

A PROCESS FOR TRANSPARENTIZING TEXTILES is described in a recent patent. By impregnating an open meshed fabric with a resin ether, in solution with an aminoplast ether resin reacted with an alkyd resin, it is claimed that the material is completely transparentized (Alkyd resins are based on glycerine and a variety of reactants). (T-15)

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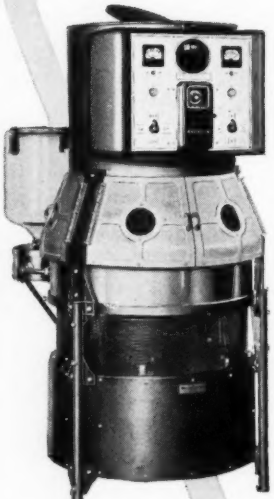

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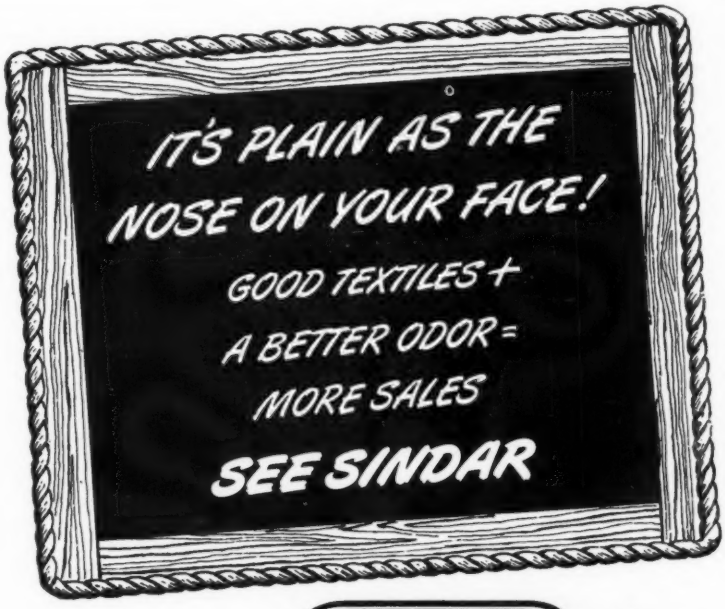

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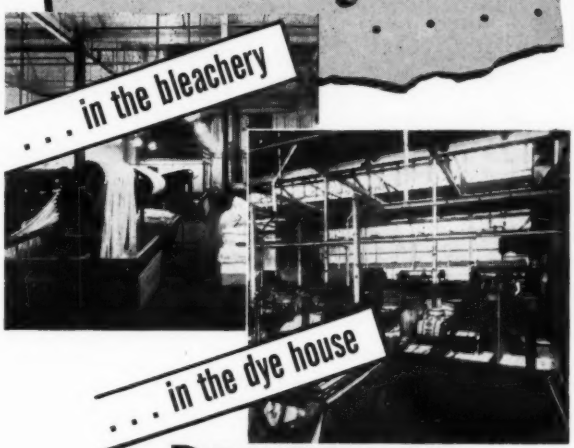

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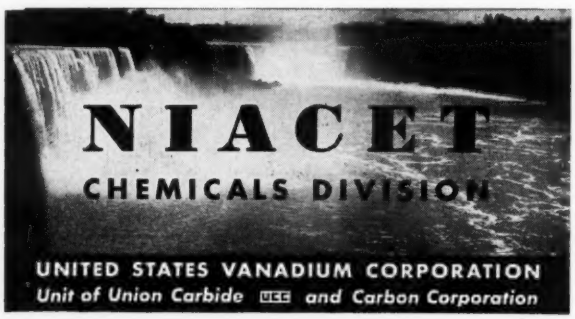

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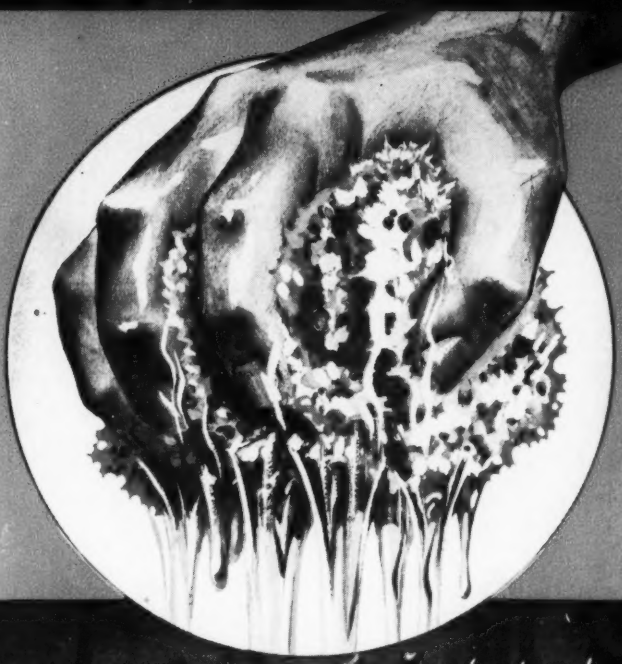

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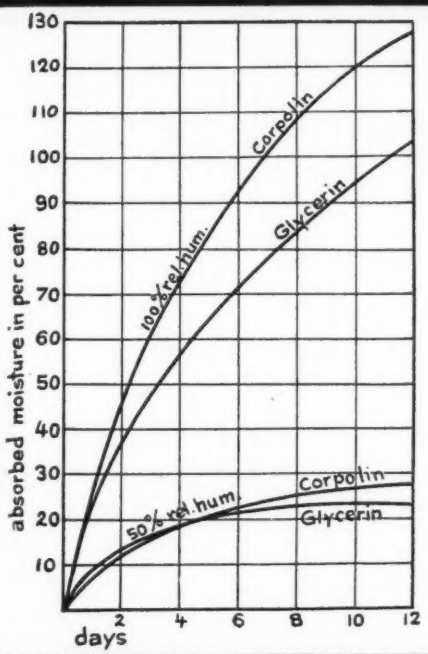


FOR VAT PRINT PASTE

Corpolin is highly effective as an ingredient of vat print paste, absorbing the proper amount of moisture in the ager. Corpolin costs less than ½ as much as glycerine, which it replaces without change in formulation. Non-toxic and non-flammable, it is the finest humectant available at any price.

FOR SIZING

Corpolin is valuable as a sizing agent . . . it prevents the sized warps from becoming dry and brittle. Gelatine and glue are softened by Corpolin and prevented from gelatinizing.

Write today for technical data sheet and samples. Prove Corpolin's effectiveness for your own process.

THE AKTIVIN DIVISION

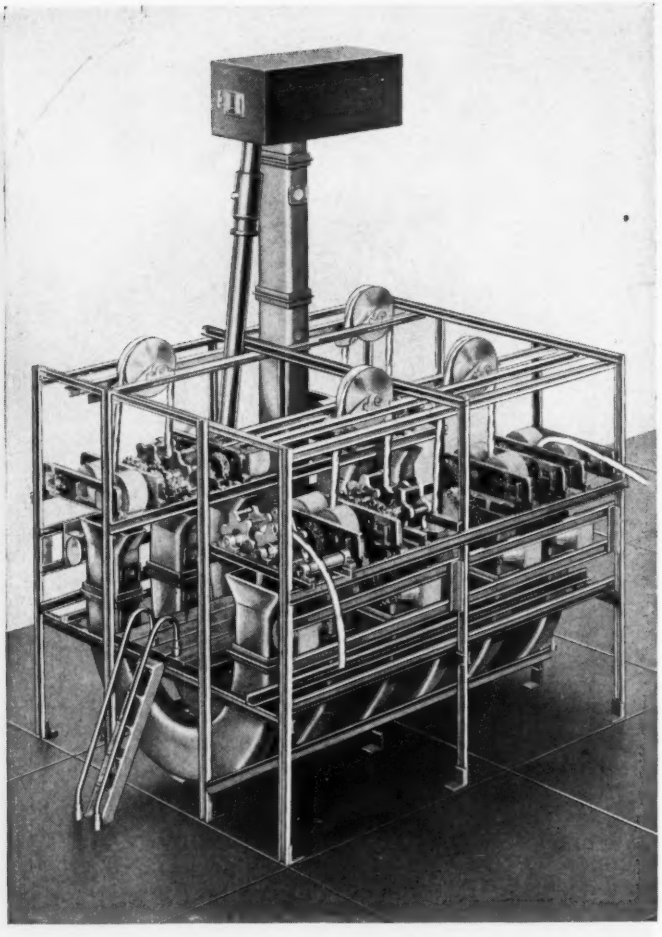
HEYDEN CHEMICAL CORPORATION

393 SEVENTH AVENUE. NEW YORK I, N. Y.

HEYDEN CHEMICAL CORPORATION THE AKTIVIN DIVISION NEW YORK

Butterworth Junior Bleaching Unit showing ease of control from operating floor in center of unit. Range includes "U"-type Washers, Saturator, J-box, reels, motors, instruments and auxiliary equipment.

Bleaching Economy starts at 300 lbs. of cloth per hour



You can put a Butterworth Junior Bleaching Unit to work profitably in your mill with a production of 300 lbs. of cloth per hour.

Junior is a *complete* bleaching range developed in conjunction with duPont for small production bleaching of knit goods or cotton piece goods. It gives the efficient small mill or the large mill running special lots the economies of continuous peroxide bleaching, including:

(1) Steam savings as high as 75%.

(2) Up to 10% saving in chemical costs.

(3) Only one man is required to run the Butterworth Junior Bleaching Unit compared with two men on conventional ranges.

The Butterworth Junior Bleaching Unit requires a floor space only 13 x 16 feet. The J-box is approximately 25 feet in height but this height requirement may be reduced somewhat by placing the bottom of the J-box in a pit below the floor line. Cloth is handled gently and efficiently with patented Butterworth tension control devices. Inspection windows permit easy checking throughout the bleaching operation.

For full details, write for Butterworth Bulletin 200.

BUTTERWORTH

H. W. BUTTERWORTH & SONS COMPANY, Phila. 25, Pa. • Providence Div., Providence R. I. • 1211 Johnston Building, Charlotte, N. C. • In Canada: W. J. Westaway Co., Hamilton, Ont.

Representatives in Principal Countries of the World

Be wise and thrifty. Write today for full details of this low cost, versatile surface-active agent—TRITON X-100.

CHEMICALS FOR INDUSTRY

ROHM & HAAS COMPANY

WASHINGTON SQUARE, PHILADELPHIA 5, PA.

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TRITON X-100 is a trade mark, Reg. U. S. Pat. Off. and in principal foreign countries.

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Now! One hand for many tasks

Dispersall N, the new Royce dispersing agent, saves both space and costs for dyers of cellulosic materials. It reduces chemical stock inventories, and better serves every purpose for which it is recommended. It provides superior retarding action in vat dyeing, without loss of color. Inhibits crocking of naphtol-fast color salt dyed and printed materials. Better levels faultily dyed vat shades. And Dispersall N is highly efficient in stripping naphtol-fast color dyed goods to a clear ground. Sales technicians available for demonstration on request.

FOR CELLULOSIC MATERIALS

VAT AND NAPHTOL DYEING

VAT AND NAPHTOL PRINTING

VAT AND NAPHTOL STRIPPING

VAT AND NAPHTOL LEVELING

- ★ Permanently Uniform
- ★ Neutral
- ★ Stable and odorless
- ★ Water-Miscible
- ★ Excellent Wetting Efficiency
- ★ Hard-Water-Resistant

Dispersall -N

Dyeing Assistant
Stripping Auxiliary

ROYCE CHEMICAL CO.

CARLTON HILL, NEW JERSEY

MANUFACTURERS OF NEOZYME* • PAROLITE* • DISCOLITE* • DRYTEX* FABRITEX* • GUMOLITE* • CASTROLITE* • VELVORAY* • ZIPOLITE*

ROYCE CHEMICAL CO.

*®